## Off

### 1

#### Space mining driving innovation now

**Casey 21**

(JP Casey—editor of Future Power Technology, Offshore Technology Focus, and MINE Magazine, “The final frontier: could biomining be the future of resource extraction in space?” Mining Technology, 02-16-2021, <https://www.mining-technology.com/features/the-final-frontier-could-biomining-be-the-future-of-resource-extraction-in-space/>)

As technological sophistication improves and financial investments grow, there is **increasing optimism** across a number of sectors that humanity is closer than ever to establishing settlements and infrastructure among the stars. With well-established groups such as NASA providing the financial backing and technical expertise, and private companies SpaceX and Blue Origin driving innovation with the relentlessness of a for-profit enterprise, the concept of space mining in particular moves ever farther from the realm of science fiction and towards a reality for the future of humanity.

This is no surprise considering the, literal, astronomical financial rewards on offer. The [oft-quoted figure](https://www.cnbc.com/2018/05/15/mining-asteroids-could-be-worth-trillions-of-dollars.html), put forward by CNBC, is that the Asteroid Belt alone contains enough mineral wealth to give every person on Earth $100bn. With commodities such as rare earths and platinum groups metals in higher demand than ever before, there is every reason to think that, in the future, many of humanity’s mineral needs could be met by mining operations beyond Earth.

Yet many of the world’s scientific communities are targeting projects closer to home, in order to demonstrate the **effectiveness of technological innovation** and the financial viability of interstellar operations. The Moon remains the centrepiece of humanity’s space efforts and research from the University of Edinburgh, tested on the International Space Station (ISS), offers a new form of mining that could be deployed on the Moon. The university’s work centred on bacteria and how it can be used to eat away at mineral deposits to reveal precious commodities. This process of “biomining” has now been proven to be effective in zero-gravity environments, raising hope for a new type of resource extraction to propel humanity to the stars.

What could be most impressive about the project, however, is that many of the technological processes behind it are not new at all, but adaptations of mining operations already used on the Earth.

“What we are doing is just transplanting and adapting something that we know works on the Earth,” explained Cockell. “About 35% of the world’s copper is extracted from rocks using microbes, so biomining is widely used on the Earth. And the reason for doing it in space is because wherever you are, whether you’re on the Moon or Mars, you want to mine minerals, at least if you want to establish an independent presence.“You don’t want to have the massive energy costs of having to launch things from the Earth [and] take them somewhere else; you ought to be able to get them locally.”This biomining process has been used extensively in Chile, which is responsible for around one-third of the world’s copper production. Projects such as the Lo Aguirre mine near Santiago, which produced 14,000 tonnes of copper a year between its commissioning in 1980 and its closure in 2002, demonstrated the effectiveness of biomining on an industrial scale, and influenced later acid leaching projects in the country. For instance, in 1994, the Quebrada Blanca and Cerro Colorado mines were among the first to use bioleaching exclusively to extract valuable minerals from excavated ore bodies.The challenge for Cockell and his team, therefore, was not one of inventing a new technological process, but demonstrating that an existing one can be effectively transplanted from the Earth to space, and adapted to function within the environmental constraints of the area.

He went on to point out that many of the challenges associated with space mining will cease to be technological in nature, and more based on logistics and financing. With the technology proven to be effective, it falls on companies and organisations to effectively allocate resources to scale up the work done by teams such as Cockell’s.

“People are thinking about mining beyond the Earth, there are groups of economists and engineers who think about these things,” he concluded. “It’s really a task for them to think about how this would be implemented, or what would be the best way of doing it.

“This [research] is definitely a first step, but it’s an exciting first step I think, as it shows that we’ve demonstrated biomining is possible in space. The next steps would be to scale this up, to try to do it on a larger-scale space station and involve not so much scientists like us but involve economists and engineers who then need to think about how they would do this on a larger scale.”

#### Private companies solve best for innovation – reducing costs, investment, and high risk-tolerance. Regulation and lack of property rights kills

Weinzierl and Elbling 2021

(“The Commercial Space Age Is Here,” Matt Weinzierl is the Joseph and Jacqueline Elbling Professor of Business Administration at HBS and a Research Associate at the NBER, Mehak Sarang is a Research Associate at Harvard Business School and the Lunar Exploration Projects Lead for the MIT Space Exploration Initiative, February 12, 2021, <https://hbr.org/2021/02/the-commercial-space-age-is-here>, accessed 1-15-2022)

In 2019, 95% of the estimated $366 billion in revenue earned in the space sector was from the space-for-earth economy: that is, goods or services produced in space for use on earth. The space-for-earth economy includes telecommunications and internet infrastructure, earth observation capabilities, national security satellites, and more. This economy is booming, and though research shows that it faces the challenges of overcrowding and monopolization that tend to arise whenever companies compete for a scarce natural resource, projections for its future are optimistic. **Decreasing costs for launch and space hardware in general have enticed new entrants into this market, and companies in a variety of industries have already begun leveraging satellite technology and access to space to drive innovation and efficiency in their earthbound products and services.** In contrast, the space-for-space economy — that is, goods and services produced in space for use in space, such as mining the Moon or asteroids for material with which to construct in-space habitats or supply refueling depots — has struggled to get off the ground. As far back as the 1970s, research commissioned by NASA predicted the rise of a space-based economy that would supply the demands of hundreds, thousands, even millions of humans living in space, dwarfing the space-for-earth economy (and, eventually, the entire terrestrial economy as well). The realization of such a vision would change how all of us do business, live our lives, and govern our societies — but to date, we’ve never even had more than 13 people in space at one time, leaving that dream as little more than science fiction. Today, however, there is reason to think that we may finally be reaching the first stages of a true space-for-space economy. SpaceX’s recent achievements (in cooperation with NASA), as well as upcoming efforts by Boeing, Blue Origin, and Virgin Galactic to put people in space sustainably and at scale, mark the opening of a new chapter of spaceflight led by private firms. These firms have both the intention and capability to bring private citizens to space as passengers, tourists, and — eventually — settlers, opening the door for businesses to start meeting the demand those people create over the next several decades with an array of space-for-space goods and services. Welcome to the (Commercial) Space Age In our recent research, we examined how the model of centralized, government-directed human space activity born in the 1960s has, over the last two decades, made way for a new model, in which public initiatives in space increasingly share the stage with private priorities. Centralized, **government-led space programs will inevitably focus on space-for-earth activities that are in the public interest,** such as national security, basic science, and national pride. This is only natural, as expenditures for these programs must be justified by demonstrating benefits for citizens — and the citizens these governments represent are (nearly) all on earth. **In contrast to governments, the private sector is eager to put people in space to pursue their own personal interests, not the state’s** — and then supply the demand they create. This is the vision driving SpaceX, which in its first twenty years has entirely upended the rocket launch industry, securing 60% of the global commercial launch market and building ever-larger spacecraft designed to ferry passengers not just to the International Space Station (ISS), but also to its own promised settlement on Mars. Today, the space-for-space market is limited to supplying the people who are already in space: that is, the handful of astronauts employed by NASA and other government programs. While SpaceX has grand visions of supporting large numbers of private space travelers, their current space-for-space activities have all been in response to demand from government customers (i.e., NASA). **But as decreasing launch costs enable companies like SpaceX to leverage economies of scale and put more people into space, growing private sector demand** (that is, tourists and settlers, rather than government employees) could turn these proof-of-concept initiatives into a sustainable, large-scale industry. This model — of selling to NASA with the hopes of eventually creating and expanding into a larger private market — is exemplified by SpaceX, but the company is by no means the only player taking this approach. For instance, while SpaceX is focused on space-for-space transportation, another key component of this burgeoning industry will be manufacturing. Made In Space, Inc. has been at the forefront of manufacturing “in space, for space” since 2014, when it 3D-printed a wrench onboard the ISS. Today, the company is exploring other products, such as high-quality fiber-optic cable, that terrestrial customers may be willing to pay to have manufactured in zero-gravity. But the company also recently received a $74 million contract to 3D-print large metal beams in space for use on NASA spacecraft, and future private sector spacecraft will certainly have similar manufacturing needs which Made In Space hopes to be well-positioned to fulfill. Just as SpaceX has begun by supplying NASA but hopes to eventually serve a much larger, private-sector market, Made In Space’s current work with NASA could be the first step along a path towards supporting a variety of private-sector manufacturing applications for which the costs of manufacturing on earth and transporting into space would be prohibitive. **Another major area of space-for-space investment is in building and operating space infrastructure such as habitats, laboratories, and factories.** Axiom Space, a current leader in this field, recently announced that it would be flying the “first fully private commercial mission to space” in 2022 onboard SpaceX’s Crew Dragon Capsule. Axiom was also awarded a contract for exclusive access to a module of the ISS, facilitating its plans to develop modules for commercial activity on the station (and eventually, beyond it). **This infrastructure is likely to spur investment in a wide array of complementary services to supply the demand of the people living and working within it.** For example, in February 2020, Maxar Technologies was awarded a $142 million contract from NASA to develop a robotic construction tool that would be assembled in space for use on low-Earth orbit spacecraft. Private sector spacecraft or settlements will no doubt have need for a variety of similar construction and repair tools. And of course, the private sector isn’t just about industrial products. **Creature comforts also promise to be an area of rapid growth, as companies endeavor to support the human side of life in the harsh environment of space.** In 2015, for example, Argotec and Lavazza collaborated to build an espresso machine that could function in the zero-gravity environment of the ISS, delivering a bit of everyday luxury to the crew. To be sure, people have dreamt of using the vacuum and weightlessness of space to source or make things that cannot be made on earth for half a century, and time and again the business case has failed to pan out. Skepticism is natural. Those failures, however, have been in space-for-earth applications. For example, two startups of the 2010s, Planetary Resources, Inc. and Deep Space Industries, recognized the potential of space mining early on. For both companies, however, the lack of a space-for-space economy meant that their near-term survival depended on selling mined material — precious metals or rare elements — to earthbound customers. When it became clear that demand was insufficient to justify the high costs, funding dried up, and both companies pivoted to other ventures. These were failures of space-for-earth business models — but the demand for in-space mining of raw building material, metals, and water will be enormous once humans are living in space (and are therefore far cheaper to supply). In other words, when people are living and working in space, we are likely to look back on these early asteroid mining companies less as failures and more as simply ahead of their time. Seizing the Space-for-Space Opportunity The opportunity presented by the space-for-space economy is huge — but it could easily be missed. To seize this moment, policymakers must provide regulatory and institutional frameworks that will enable the risk-taking and innovation necessary for a decentralized, private-sector-driven space economy. There are three specific policy areas we believe will be especially important: 1. **Enabling private individuals to take on greater risk than would be tolerable for government-employed astronauts.** First, **as part of a general shift to that more decentralized, market-oriented space sector, policymakers should consider allowing private space tourists and settlers to voluntarily take on more risk than states would tolerate for government-employed astronauts.** In the long run, ensuring high safety levels will be essential to convince larger numbers of people to travel or live in space, but in the early years of exploration, too great an aversion to risk will stop progress before it starts. An instructive analogy can be found in how NASA works with its contractors: In the mid-2000s, NASA shifted from using cost-plus contracts (in which NASA shouldered all the economic risk of investing in space) to fixed-price contracts (in which risk was distributed between NASA and their contractors). **Because of private companies’ greater tolerance for risk, this shift catalyzed a burst of activity in the sector** — sometimes referred to as “New Space.” A similar shift in how we approach voluntary risk-taking by private-sector astronauts may be necessary in order to launch the space-for-space economy. 2. Judiciously implementing government regulation and support. Second, as with most markets, developing a stable space economy will depend on judicious government regulation and support. NASA and the U.S. Commerce and State Departments’ recent recommitment to “create a regulatory environment in [low-Earth orbit] that enables American commercial activities to thrive” is a good sign that the government is on a path of continued collaboration with industry, but there’s still a long way to go. Governments should start by clarifying how property rights over limited resources such as water on Mars, ice on the Moon, or orbital slots (i.e., “parking spots” in space) will be governed. Recent steps — including NASA’s offer to purchase lunar soil and rocks, last April’s Executive Order on the governance of space resources, and the 2015 Commercial Space Launch Competitiveness Act — indicate that the U.S. government is interested in establishing some form of regulatory framework to support the economic development of space. In 2017, Luxembourg became the first European country to establish a legal framework securing private rights over resources mined in space, and similar steps have been taken at the domestic level in Japan and the United Arab Emirates. Moreover, nine countries (though Russia and China are notably missing) have signed the Artemis Accords, which lay out a vision for the sustainable, international development of the Moon, Mars, and asteroids. These are important first steps, but they have yet to be clearly translated into comprehensive treaties that govern the fair use and allocation of scarce space resources among all major spacefaring nations. In addition, governments should continue to fill the financial gaps in the still-maturing space-for-space economic ecosystem by funding basic scientific research in support of sending humans to space, and by providing contracts to space startups. Similarly, while excessive regulation will stifle the industry, some government incentives, such as policies to reduce space debris, can help reduce the costs of operating in space for everyone in ways that would be difficult to coordinate independently. 3. Moving beyond geopolitical rivalries. Finally, the development of the space-for-space economy must not be undermined by earthly geopolitical rivalries, such as that between the United States and China. These conflicts will unavoidably extend into space at least to some extent, and military demand has long been an important source of funding for aerospace companies. But if not kept in check, such rivalries will not only distract attention and resources from borderless commercial pursuits but also create barriers and risks that hamper private investment. On earth, private economic activity has long tied together people whose states are at odds. The growing space-for-space economy offers exceptional potential to be such a force for unity — but **it’s the job of the world’s governments not to get in the way**. A collaborative, international approach to establishing — and enforcing — the rule of law in space will be essential to encouraging a healthy space-for-space economy. Visions of a space-for-space economy have been around since the dawn of the Space Age in the 1960s. Thus far, those hopes have gone largely unmet — but this moment is different. **For the first time in history, the private sector’s capital, risk tolerance, and profit motive are being channeled into putting people in space. If we seize this opportunity, we will look back on 2020 as the year when we started the truly transformational project of building an economy and a society in space, for space.**

#### Innovation solves every existential threat

Dylan **Matthews 18**. Co-founder of Vox, citing Nick Beckstead @ Rutgers University. 10-26-2018. "How to help people millions of years from now." Vox. <https://www.vox.com/future-perfect/2018/10/26/18023366/far-future-effective-altruism-existential-risk-doing-good>

If you care about improving human lives, you should overwhelmingly care about those quadrillions of lives rather than the comparatively small number of people alive today. The 7.6 billion people now living, after all, amount to less than 0.003 percent of the population that will live in the future. It’s reasonable to suggest that those quadrillions of future people have, accordingly, hundreds of thousands of times more moral weight than those of us living here today do. That’s the basic argument behind Nick Beckstead’s 2013 Rutgers philosophy dissertation, “On the overwhelming importance of shaping the far future.” It’s a glorious mindfuck of a thesis, not least because Beckstead shows very convincingly that this is a conclusion any plausible moral view would reach. It’s not just something that weird utilitarians have to deal with. And Beckstead, to his considerable credit, walks the walk on this. He works at the Open Philanthropy Project on grants relating to the far future and runs a charitable fund for donors who want to prioritize the far future. And arguments from him and others have turned “long-termism” into a very vibrant, important strand of the effective altruism community. But what does prioritizing the far future even mean? The most literal thing it could mean is preventing human extinction, to ensure that the species persists as long as possible. For the long-term-focused effective altruists I know, that typically means identifying concrete threats to humanity’s continued existence — like unfriendly artificial intelligence, or a pandemic, or global warming/out of control geoengineering — and engaging in activities to prevent that specific eventuality. But in a set of slides he made in 2013, Beckstead makes a compelling case that while that’s certainly part of what caring about the far future entails, approaches that address specific threats to humanity (which he calls “targeted” approaches to the far future) have to complement “broad” approaches, where instead of trying to predict what’s going to kill us all, you just generally try to keep civilization running as best it can, so that it is, as a whole, well-equipped to deal with potential extinction events in the future, not just in 2030 or 2040 but in 3500 or 95000 or even 37 million. In other words, caring about the far future doesn’t mean just paying attention to low-probability risks of total annihilation; it also means acting on pressing needs now. For example: We’re going to be better prepared to prevent extinction from AI or a supervirus or global warming if society as a whole makes a lot of scientific progress. And a significant bottleneck there is that the vast majority of humanity doesn’t get high-enough-quality education to engage in scientific research, if they want to, which reduces the odds that we have enough trained scientists to come up with the breakthroughs we need as a civilization to survive and thrive. So maybe one of the best things we can do for the far future is to improve school systems — here and now — to harness the group economist Raj Chetty calls “lost Einsteins” (potential innovators who are thwarted by poverty and inequality in rich countries) and, more importantly, the hundreds of millions of kids in developing countries dealing with even worse education systems than those in depressed communities in the rich world. What if living ethically for the far future means living ethically now? Beckstead mentions some other broad, or very broad, ideas (these are all his descriptions): Help make computers faster so that people everywhere can work more efficiently Change intellectual property law so that technological innovation can happen more quickly Advocate for open borders so that people from poorly governed countries can move to better-governed countries and be more productive Meta-research: improve incentives and norms in academic work to better advance human knowledge Improve education Advocate for political party X to make future people have values more like political party X ”If you look at these areas (economic growth and technological progress, access to information, individual capability, social coordination, motives) a lot of everyday good works contribute,” Beckstead writes. “An implication of this is that a lot of everyday good works are good from a broad perspective, even though hardly anyone thinks explicitly in terms of far future standards.” Look at those examples again: It’s just a list of what normal altruistically motivated people, not effective altruism folks, generally do. Charities in the US love talking about the lost opportunities for innovation that poverty creates. Lots of smart people who want to make a difference become scientists, or try to work as teachers or on improving education policy, and lord knows there are plenty of people who become political party operatives out of a conviction that the moral consequences of the party’s platform are good. All of which is to say: Maybe effective altruists aren’t that special, or at least maybe we don’t have access to that many specific and weird conclusions about how best to help the world. If the far future is what matters, and generally trying to make the world work better is among the best ways to help the far future, then effective altruism just becomes plain ol’ do-goodery.\*

### 2

#### Counterplan: States should ban asteroid relocation done by private entities. States should ban mining on the moon. Spaces should create an agreement modeled after UNCLOS that regulates how private entities operate in space, recognizes property rights of commercial entities, and the right of non-spacefaring nations to benefit.

#### This whole aff is a lie. Their crucial link card is not about asteroid mining in general and their cutting leaves out key context. It’s about moving asteroids nearby and mining them in our orbit. It makes no sense at all to say mining distant asteroids would put debris into low earth orbit and the full card concedes that they’re all only describing relocating asteroids which they distinguish from mining them on site. Here’s their author: [I read YELLOW]

Sarah Scoles 15, “Dust from asteroid mining spells danger for satellites,” New Scientist, 5-27-2015, <https://www.newscientist.com/article/mg22630235-100-dust-from-asteroid-mining-spells-danger-for-satellites/>

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. Handmer and Roa want to point out the problem now so that we can find a solution before any satellites get dinged. “It is possible to quantify and manage the risk,” says Handmer. “A few basic precautions will prevent harm due to stray asteroid material.”

#### Their author also agrees asteroid mining is fundamentally good and the CP wouldn’t get circumvented or rolled back as long as we do it now

Sarah Scoles 15, “Dust from asteroid mining spells danger for satellites,” New Scientist, 5-27-2015, <https://www.newscientist.com/article/mg22630235-100-dust-from-asteroid-mining-spells-danger-for-satellites/>

Aspiring space miners are taking the risk seriously. “We will be utilising containment techniques,” says Meagan Crawford of Deep Space Industries, a California-based firm which hopes to be mining metals from asteroids by 2020. One possibility is bagging, in which the asteroid is placed in a kind of shroud to prevent dust and loose stones from escaping. “All of our mining targets will be chosen specifically to minimise the risk of particulate interaction with other bodies,” she says.

The risk from NASA’s mission, planned for the 2020s, is small, Nolan points out. But if space mining takes off, things will get complicated. “**The establishment of good asteroid mining practices early on is essential** for the preservation of a non-renewable resource: uncluttered space,” says Handmer.

#### The second plank solves the moon mining scenario in their Boley evidence.

#### Last plank solves every conflict scenario-

Foster 16 – Craig, J.D., University of Illinois College of Law, “EXCUSE ME, YOU’RE MINING MY ASTEROID: SPACE PROPERTY RIGHTS AND THE U.S. SPACE RESOURCE EXPLORATION AND UTILIZATION ACT OF 2015”, *JOURNAL OF LAW, TECHNOLOGY & POLICY*, No. 2, page 428-430, http://illinoisjltp.com/journal/wp-content/uploads/2016/11/Foster.pdf

There are many reasons to be excited about the prospect of mining resources from space. Hopes are high that these mining efforts will provide an economic boon by producing jobs and injecting more money into the economy. 214 Additionally, the negative impact of mining natural resources on Earth is widely reported215 and might be mitigated by space mining. If mining precious resources from space can minimize the burden on Earth, then this would lend even greater support for asteroid mining. Finally, little enchants the human mind and propels innovation more than sending people and manmade objects into space. For good reason, there is much enthusiasm about the prospect of space mining. On the other hand, it is troublesome to some that private, commercial entities will be paving the way and making up many of the rules as they go. Might this lead to repeating many of the mistakes humans have made on Earth? Might there be unforeseen problems that could spell trouble if mining efforts are not properly regulated? The answer to these questions is likely “yes” as well. It will be important in the coming years to balance the former excitement against the latter caution. Space might seem limitless and impossible to affect in any significant fashion; but, history must be a major voice for the spacemining industry.216 It must be remembered that humans can make an impact that will be felt for generations to come. Thus, it will be important that lawmakers and the international community be as proactive as possible—both in outlining property rights and protecting the final frontier from being harmed by an industry that might become overzealous if left unchecked. Specifically, it will be vital for countries to enter into some sort of international agreement. One option is to create an agreement similar to UNCLOS, which would regulate how individual states and their citizens interact with resources mined from space.217 Such an agreement should recognize not only the property rights of the extracting commercial entities but also the rights of non-spacefaring countries to benefit from the minerals as well. This might include the creation of an international body, much like the ISA, that will ensure that the interests of all nations are maintained by distributing funds and technology to less wealthy or non-spacefaring nations. The U.S. would do well to help create and ratify such an agreement— something they have failed to do with UNCLOS. If the U.S. and other countries are uneasy about entering into such a restrictive agreement, they might also consider an international regulatory body and scheme much like the one used for satellites. The International Telecommunications Union (ITU) is a United Nations agency that, among other services, provides the international community with uniform satellite orbit oversight and regulatory guidance.218 Currently, 193 countries follow the ITU regulations and utilize their services, which have been likened to domain name registration.219 In the same way, spacefaring countries could form an international body that helps create and maintain a uniform space-mining legal framework.220 Without some sort of international framework as described above, the U.S. and other space-mining countries leave themselves open to great conflict and will be required to patch together a multitude of treaties between themselves as problems inevitably arise.221 V. CONCLUSION The idea of mining resources from celestial bodies is something that has always been relegated to video games and sci-fi movies. But as technology continues to progress at an exponential rate, such mining is starting to come within the realm of possibility. A number of companies are currently creating prospecting technologies that will allow them to determine exactly what an individual asteroid holds. They hope to eventually harvest these resources and sell them for lucrative profits. Fortunately for these companies, the current legal regime governing property rights to space resources is undergoing rapid change at the national level. The U.S. recently passed the Space Resource Exploration and Utilization Act of 2015, which explicitly entitles U.S. citizens to property rights over any space resources they obtain. This is certain to induce confidence in U.S. investors. The situation at the international level is different. Current international space agreements are vague, lacking in consensus, and provide little precedent for ownership of space resources. This has led the international community to move in the direction of creating a better regulatory framework, but this movement is still in discussion stages and is likely to take a while to come to fruition.

## Space War

### CP Solves

#### CP solves conflicting property rights- the only warrant in the Jamasmie evidence is that there’s no framework, both CPs solve

#### The Funnell ev says conflict over any space asset is inevitable and asteroids of only “heightened the danger” so they can’t solve the broader incentive

### Turn

#### Commercial space peace theory is true and solves all space war- private actors are key- they create linkages that jack up the costs of conflict

Cobb, 21 -- PhD, Associate Professor of Strategy and Security Studies at the SAASS

[Wendy N. Whitman Cobb, SAASS is the School of Advanced Air and Space Studies, received a BA and MA from the University of Central Florida, USA, in Political Science, and a PhD in Political Science from the University of Florida, USA, "Privatizing Peace: How Commerce Can Reduce Conflict in Space," Chapter 3: Logics of peace, p. 37-51, and Chapter 4: The commercial space peace, p. 56-73, footnotes omitted, Routledge, 2021, <https://doi.org/10.4324/9780429321917>, accessed 1-26-22]

On March 27, 2019, Indian Prime Minister Narendra Modi announced the successful test of an anti-satellite (ASAT) weapon making India the fourth country (following the United States, Russia, and China) to perform such a feat. In his announcement, Prime Minister Modi stated, “India has made an unprecedented achievement today. India registered its name as a space power.”1 Modi’s claim to space power is an interesting one. Many space scholars argue that the achievement of human spaceflight represents the top rungs of space hierarchy, something the Indians have not yet achieved though plans are ongoing.2 By this measure, India does not rank among the space powers of the United States, Russia, and China. On the other hand, the ability to target and destroy a satellite in earth orbit is a significant accomplishment, one which could easily threaten not just India’s adversaries, but all those who utilize space-based assets.

The test, occurring approximately 300 kilometers in orbit around the earth, created a cloud of debris most of which, because of the relatively low altitude of the test, will eventually burn up in the earth’s atmosphere. However, more than 400 pieces of debris were subsequently identified by NASA with 60 large enough to be tracked. Of those 60, according to NASA Administrator James Bridenstine, 24 were high enough in altitude to threaten the International Space Station (ISS), significantly increasing the chances of the ISS needing to maneuver out of the way of oncoming debris.3 As the space around the earth becomes more crowded and perhaps occupied by humans, the chances of orbital debris impacting valuable spacebased infrastructure, or even a crewed mission, will only increase. Given the extent to which the global economy is dependent on such infrastructure, the destruction of satellites, even if accidental, will likely have such a global and significant impact that it might dissuade countries from engaging in such activities to begin with.4

The timing of the Indian test was also interesting, coming on the heels of an increase in tension between India and Pakistan in February of 2019. Following a suicide attack by a Pakistan-based terrorist organization in Kashmir that killed 40 Indian security personnel, India launched air strikes against Pakistan.5 Though diplomacy prevailed, the provocation in the long simmering dispute over Kashmir heightened fears that the two nuclear powers might engage in further militarized conflict. While there are no indications that the ASAT test was directly intended as a display of power in the wake of the incident (indeed, India attempted an ASAT launch earlier in February which failed), the test and Modi’s assertion of space power can only serve as a warning, not just to Pakistan, but also to India’s other regional rival, China.

India, like its fellow democratic country the United States, is an example of a somewhat paradoxical finding in international relations scholarship. Scholars have noted that democracies tend not to go to war with other democracies though they are just as likely to engage in conflict as non-democracies. The so-called democratic peace is empirically accepted though its causal mechanisms remain in dispute (to be discussed further in this chapter). Some policymakers have seized on the argument and used it to support the expansion of democracy even via military means. In this sense, Erich Weede writes that, “Legitimating current wars by hopes for regime change and future pacific benefits is dangerous.”6 As an alternative, Weede argues that a capitalist peace is far less dangerous than regime change and far more pacifying. Like the democratic peace, proponents of the capitalist peace argue that as countries become more capitalistic and more connected through trade relations and interdependent economies, the cost of conflict to the shared economy between two countries becomes so great that there is no incentive to engage in militarized battle. Given that not all space powers are democracies or capitalists, the various paths to peace that the democratic and capitalist peace theories offer are not applicable to the space environment. Another economically-based argument, however, is.

This chapter briefly reviews the evolution of theories of peace that fall largely under the umbrella of the Kantian peace. As described in Chapter 1, Kant argued that states could attain “perpetual peace” through a combination of democracy, economic involvement, and the usage of international organizations. Following the realization that democracies do not go to war with other democracies, international relations scholars returned to this notion to try to understand causes of peace in the modern world. It is out of this literature that the capitalist, commercial, and economically interdependent peace arguments (some argue the three are distinct, but the terms have been used interchangeably to a point) emerge. While this chapter discusses this research, it is important to make clear what the chapter is not—it is not a full review of the democratic, capitalist, or commercial peace literature nor is it a critique of it. This chapter focuses mostly on the causal mechanisms that scholars have proposed to explain the lack of conflict between certain types of states to build a causal story regarding economic dependence on space-based assets and how that can reduce conflict in space. As I will develop in the following chapter, the commercial space peace theory is built on and derived from research regarding the economic peace in particular. The end of this chapter discusses some of the methodological challenges highlighted by this research that must be confronted in explicating such a theory.

The democratic peace

Though Kant and other Enlightenment thinkers argued for the pacific power of democracy centuries ago, the democratic peace, as well as international organizations and economics, received renewed interest by the end of the Cold War.7 While scholars focused largely on the democratic peace, findings regarding the role of trade and the economy led others to more heavily focus on the role of economic connections. Even though the democratic peace does not play a large role in a theory regarding conflict in space, it is important to the extent that it fostered a more extensive development of economic and commercial peace theories.

In a review of democratic peace research in 2014, Havard Hegre, a prominent scholar in the area, notes that, despite various findings regarding the causes of democratic peace, there is wide agreement that the absence of conflict among democracies is about as close to an empirical law in international relations as can be found.8 It is on the point of causal mechanisms that scholars have strongly disagreed, proposing theories that range from how leaders are selected, the legislative constraints on state leadership, and public opinion, to more normative arguments regarding the nature of democracy itself. One early theory was that the political institutions of a democracy somehow constrain its leaders from going to war. Though there has been some supportive evidence in this vein, if true, these constraints should also prevent democracies from going to war with non-democracies which has not been empirically demonstrated. Given this failing, scholars like Bruce Russett proposed a normative based explanation. Because democracies (generally) resolve internal disputes through non-violent political means, democracies should be able to externalize the peaceful means of conflict resolution, particularly in their dealings with other democratic states. In other words, democracies share a “norm of conduct” which governs their behavior with one another.9 In building on this hypothesis, Erik Gartzke suggests that democracies share similar interests which reduces the chances for conflict among them.10 Despite the appeal of common beliefs, this line of research fell victim to methodological concerns regarding measurement of key variables, the inclusion or exclusion of control variables, and the proper level at which the theory should be tested (at the state level or the dyadic level).11

Bruce Bueno de Mesquita and his co-authors suggest a variation of the institutional theory but focused on the selection of leadership and how leaders can satisfy their “selectorate,” the subset of the electorate that forms a winning coalition which an incumbent leader must continue to satisfy in order to remain in office.12 The leader can use the provision of resources to “pay off” the selectorate and help ensure their reelection. Democratic leaders must “pursue policies oriented toward public goods rather than private goods, because a larger portion of the society participates in the electoral process.”13 As a result, democratic leaders are often more concerned about policy failure which they seek to reduce; in the case of conflict, they are more likely to expend a greater amount of resources than autocratic leaders in order to ensure a victory. While at first glance this may appear to predict more conflict-prone relationships among democracies, “leaders of democratic regimes know about the resolve and resources that another democratic leader is willing to commit to victory, serving as a deterrent to escalation” between two democratic states.14 Later work provided substantial empirical support,15 however, like much of the work on the democratic peace, selectorate theory has also received its share of methodological critiques.16 Ungerer notes that later research focusing on the consequences of losing for autocratic and democratic leaders, an important implication, introduces more wrinkles for selectorate theory which have increased empirical doubt on the idea.17

Yet another concern about the democracy-peace relationship arose in considering whether there was a variable that was inducing democracy to begin with, suggesting that democracy might be an intermediate variable rather than the ultimate cause of peace. Elaborated by Michael Mousseau, economic norms theory proposes that social norms are influenced by economic norms. In those states that develop contract intensive economies,

individuals in developed market economies tend to share the social and political values of exchange-based cooperation, individual choice and free will, negotiation and compromise, universal equity among individuals, and universal trust in the sanctity of contract.18

If, in turn, these economic values are institutionalized in a society, “then it follows that market values favor democratic institutionalization.”19 Democracies, developed in this way, would share common values and outlooks which should lead to more peaceful relations. Mousseau’s empirical analysis finds support for this thesis and in particular finds that democratic peace is stronger in countries that have a greater level of economic development. Mousseau, in a later article, does not mince words:

There is no justification for inferring or implying any evidence herein, direct or indirect, as corroborating the causation from democracy to peace. . . . [T]here is little correlational evidence of democracy causing peace, whether we gauge peace with wars, fatal and nonfatal militarized interstate conflicts, or interstate crises.20

Though Mousseau takes a strong stance on the lack of a role for democracy, several other analyses, including his own, suggest a more interactive relationship between trade, economics, and democracy.21

The democratic peace thesis is not without its critiques, many of them methodological in terms of measuring key elements like conflict and democracy.22 While this is not the place to fully discuss them or the policy consequences arising from the belief that democracy reduces conflict, for the purposes of the analysis here, the democratic peace theory does not offer a viable path to explaining lack of conflict in space. Of the major space powers (Russia, China, and the United States), only the United States is considered democratic and several other non-democratic states are also involved in space activities (these states and their activities will be taken up further in Chapter 6). To date, there has been no actual instances of conflict in space, and while counterfactuals are notoriously difficult to prove, democracy does not appear to be a primary cause leading to the lack of it. Again, what is important to take from this discussion is that renewed interest in the pacific effects of economics has been an important offshoot of this research program.

The economic peace

Space is integral to the global economy. Today, it is used to transmit information across the globe in seconds, enabling economic transactions, stock markets, and real-time communications for companies with multiple locations around the world. Weather data and forecasting, enabled by space-based monitoring, are cornerstones of economic activities including agriculture, resource development, fishing, and tourism. Given the extent to which the global economy is dependent on space-based infrastructure, economic theories of peace provide far more promise in explaining a lack of conflict in space.

What I have termed the “economic peace” has been discussed under a variety of names including the capitalist peace, the commercial peace, or the trade peace depending on the causal mechanism at play. Even among scholars, identification of the capitalist peace, commercial peace, or globalization peace has been quite varied and are usually overlapping. For example, Gerald Schneider and Nils Petter Gleditsch describe the capitalist peace as “various facets of capitalism, ranging from increased development to free trade and foreign investment, are positively related to peace.”23 Weede, in an article about peace through globalization, appears to connect capitalism to globalization itself.24 Other scholars, however, have focused more closely on a commercial peace which involves interdependent and extensive trade relations, just a small part of the capitalist peace described by Schneider and Gleditsch. It is beyond the scope of the book to fully explain these differences; what is important to note is that, like the democratic peace, there are various explanations for how economics translates into peace. This brief review looks at just a few including capitalism, integration with global markets and trade, signaling, and bargaining costs.

The larger capitalist peace literature is a convenient jumping off point to explore arguments regarding the economic peace. However, a definition of it is hard to pin down. As Mousseau points out, the definitions of capitalism are quite diverse and the way in which scholars have tested the idea that capitalism creates less conflict have differed.25 Scholars have used various measures of capitalism including free trade, trade interdependence, the openness of markets, and market norms, none of which automatically equate with capitalism. Even in a symposium on the capitalist peace in the journal International Interactions, three different empirical analyses use three different measures of capitalism.26 The capitalist peace literature suffers from other shortcomings beyond lack of consensus about the definition and operationalization of capitalism. John Mueller argues that the acceptance of capitalism on its own is not enough to lead to peace.27 In addition to capitalistic markets, states also need to accept that economic prosperity and development are worthy goals, see peace as a better motor for economic development, and believe that trade will get them further than conquest. Despite Weede’s assertion that capitalism is more pacifying than democracy, Russett cautions that the democratic peace still holds significant explanatory power and that adequate causal mechanisms that integrate the two are difficult to establish.28 Finally, Richard Rosecrance warns that capitalism, far from promoting peace, may actually cause conflict by heightening inequalities among populations and stimulating nationalist attitudes.29 Indeed, despite hopes at the turn of the twentieth century that economic relations could stem conflict, World War I serves as a significant counterargument that will be discussed further in what follows.

Like democracy, not all states that engage in space activities are capitalist. Instead, it may be more profitable to focus on specific aspects of markets that might reduce the chances of conflict like peace through trade. Solomon Polachek hypothesizes, for instance, that among pairs of countries, mutual trade should reduce conflict because the more countries are dependent on one another, the more likely it is that conflict will disrupt those valuable trade relations.30 Polachek writes, “Ceteris paribus, the greater the amount of trade, the higher the price of conflict, and the less the amount of conflict that is demanded.”31 Conflict is discouraged because of the potential for damage to each country’s economic health. Polachek finds empirical support for the hypothesis and he is far from alone in the finding.32

Other scholars have proposed that it is actually a state’s interdependence with and integration in the global market that explains lack of conflict.33 For them, trade is only one part of an interdependent relationship that can also consist of foreign direct investment and movement of capital. In this variation, the meaning of interdependence is important with much of this literature building on work done by Robert O. Keohane and Joseph S. Nye beginning in the 1970s. In Power and Interdependence, Keohane and Nye define interdependence as “mutual dependence” and identify two dimensions of it, sensitivity and vulnerability.34 “Sensitivity involves degree of responsiveness within a policy framework—how quickly do changes in one country bring costly changes in another, and how great are the costly effects?”35 On the other hand, “The vulnerability dimension of interdependence rests on the relative availability and costliness of the alternatives that various actors face.”36 Interdependence is distinct from interconnectedness in this account specifically in terms of how costly the effects of exchange are: “Where there are reciprocal (although not necessarily symmetrical) costly effects of transactions, there is interdependence. Where interactions do not have significant costly effects, there is simply interconnectedness.”37 For Keohane and Nye, then, a country’s interdependence with one another and the global economy is measured in terms of degree; some countries can be more interdependent than others and the more interdependence there is, the greater the chance for peace.38

While the findings regarding trade interdependence and peace are supportive, there are a number of ways the relationship has been hypothesized to work. One is that trade and increased economic value represent an opportunity cost that is foregone when conflict is pursued; therefore as opportunity costs increase, states should be less willing to go to war. For William Reed, economic interdependence reduces uncertainty and lowers information costs for states that may be contemplating armed conflict.39 From this bargaining perspective, conflict can emerge between two states who are unsure of each other’s resolve in settling disputes with war being one way of demonstrating resolve, albeit a costly way. Recognizing that conflict is likely to harm a country’s economy, a country can demonstrate how far it is willing to go to settle a dispute by the amount of harm the country is willing to absorb economically. In comparing the effect of the opportunity cost and signaling argument, Nam Kyu Kim finds stronger empirical support for signaling as the underlying causal mechanism.40 However, in a comparative case study looking for specific examples where states are actively using economic signaling in the lead up to a conflict, Allan Dafoe and Nina Kelsey find evidence to support the argument only in larger cases of conflict.41

A final strain of economic peace theory specifically speaks to globalization. There is an extensive literature on the effects of globalization in general and, again, it is not my intent for this discussion to have a comprehensive review of it. Instead, I will focus solely on the argument that globalization can have a moderating effect on conflict. Like capitalism, globalization has many definitions.42 Common usage of the term seems to infer globalization as a growing set of connections among countries, their citizens, and their economies that are all serving to “shrink” the globe in some way. No matter the definition of globalization, the hypothesis is that the increased connections made through globalization serve to reduce conflict. For example, in a study comparing the effects of trade and democracy on military expenditures of India and Pakistan, Syed Mansoob Murshed and Dawood Mamoon find that while both globalization and bilateral trade reduce military spending, it is a country’s degree of openness to the world, not bilateral trade, that is the dominant economic factor.43 Further, for some like Seung-Whai Choi, both the positive and negative effects of globalization can help to explain the conflicting findings about the role of trade in reducing conflict.44 Choi writes,

[A]lthough some features of multiple global forces may appear to be mutually incompatible and conflicting, their overall consequences nevertheless converge into a benign force facilitating common peaceful disposition among national leaders who are then likely to prefer peace to war in times of crisis.45

Choi’s analysis, which covers 1970–2001, finds that when globalization is compared to the effects of democracy, trade, and involvement in international organizations (the traditional Kantian triangle), “globalization in its totality . . . promotes peace over and above what researchers have come to expect from the three Kantian perspectives.”46

Gartzke, focusing on globalization as integration of markets, argues that market integration can serve as mechanisms not only through which states reveal information about their resolve but also as a means through which states can coerce each other. “An economically integrated target can be coerced by the threat of losing valuable exchange, but a nonintegrated initiator cannot make its threats credible or informative.”47 His analysis shows that dyads, or pairs of states, with the least integrated markets are about five times as likely to experience a militarized dispute than those with more integrated markets. Further developing the line of argument that globalization can provide a means of signaling, Gartzke and Li assert that “Globalization facilitates costly signaling by making leaders’ talk costly and thus reducing the incentives to bluff.”48 If leaders can bluff and threaten without cost, there is no way to know whether it is simply a feign or a real threat. However, if there is a market consequence to a threat that draws capital and investment away from that leader, the individual assumes a particular cost. If they are willing to accept that cost, it reveals something about the resolve of the leader. If they are not willing to accept the cost, it also shows a lack of resolve. Finally, from a different perspective, Brooks finds that increased globalization reduces the benefits of conquest to such an extent that states should no longer find the benefits of conflict outweigh the costs.49

On the other hand, Christina L. Davis and Sophie Meunier argue that globalization has proceeded to such a point that sunk costs so high that there is no incentive to reduce trade in the case of conflict.

Sunk costs for export firms include information about market conditions for successful product selection and development of distribution, sales, and servicing networks. Once firms have established exports to a particular market, they do not quickly change their trading patterns.50

Instead of globalization as a means to transmit resolve and bargaining information, globalization is absorbing the shocks of the potential threats. Though Davis and Meunier focus only the United States and Japan between 1990 and 2006, they find that trade flows do not decrease following negative events. Additionally, Katherine Barbieri and Jack S. Levy, expecting to find that trade is impacted during periods of crisis between two states, instead find that conflict does not systematically reduce trade, casting doubt on its peaceful consequences to begin with.51

The various arguments that economic connections, whether they be trade, the flow of capital, foreign investment, or globalization hold significant promise for their application to space. While trade is not necessarily taking place in space (states are not physically exchanging goods), the space-based infrastructure serves as vital connections in the global economy that facilitate such exchange. Though conflict in space may arise because of a militaristic or defensive concern, policymakers cannot separate that from the economic consequences a militarized conflict in space will have. Thus, globalization serves to connect not just states and economies, but it creates linkages among policy areas that cannot be ignored.

Before pursuing this line of thought further, however, there are several significant critiques of the various economic peace arguments. First, Paul Krugman notes that states themselves do not engage in trade, firms do.52 Given this, scholars must identify the links between private trade activity and government actions (or inactions) in order to fully develop this type of model. All too often in the economic peace literature, these linkages are taken for granted or not dealt with explicitly, but among those scholars who have taken this deficit seriously, several relationships between private entities and state governments have been supposed. David H. Bearce and Sawa Omori have advanced three potential causal models: One, the presence of commercial institutions increases the opportunity costs for states to engage in war. Two, some commercial institutions provide information on the military status of competing states thereby easing bargaining and information costs. And three, commercial institutions have the capability of bringing states and their leaders together on a regular basis which can promote trust and cooperation, ties which can be important in the lead up to war.53 In both Bearce and Omori’s empirical work and Bearce’s comparative case study, only the third mechanism, increased ties between leaders, is supported.

By no means, though, are these three linkages between states and economic actors the only possible ones. As McDonald notes, governments have a significant role in organizing a state’s economy; they set monetary and fiscal policy, provide subsidies to different industries (for example, agriculture or oil), set tariffs, and can take any number of other actions to encourage or discourage economic behavior on the parts of individuals and corporations.54 But why do states engage in such behaviors? At least in the American context, scholars have long recognized the importance of the overall state of the economy to the election hopes of public officials: if the economy is doing well or has improved, leaders are more likely to ensure their own reelection.55 If leaders want to ensure their reelection, then improving a state’s economy is one way to do so.56 This reelection incentive is one very powerful link between a state’s actions and trade relations. If a conflict could threaten a state’s economy or trading relations with another country and if politicians are sensitive to economic arguments, they may be less likely to engage in conflict with that state out of selfish electoral reasons. Katja B. Kleinberg and Benjamin O. Fordham provide support for this argument by finding that members of the US House of Representatives appear to be influenced by the export orientation and import sensitivity of their districts when voting on issues related to China.57 This line of reasoning shares similarities with Bueno de Mesquita et al.’s selectorate theory as well: leaders, wishing to please their selectorate, pursue policies that will benefit their voters. When times are good economically, the selectorate benefits.

The economy-election hypothesis is a strong one with a long history of empirical support across global contexts. While this does not discount the mechanisms proposed by Bearce and Omori, election offers a powerful and parsimonious explanation for why states are interested in and concerned about trade relations. Of course, this does not guarantee that states will always act with their economic best interests at heart nor that the economy will be the sole concern. Often, states may undertake actions that harm their own economy because they have a stronger noneconomic rationale for doing so. On the other hand, thinking in terms of economic interests could also produce conflict of the type it has been theorized to prevent. This leads to the second serious critique of the economic peace hypotheses.

Prior to World War I, Norman Angell proposed in The Great Illusion the idea that has been discussed here—that economic ties and trade interdependence would make conflict irrational for states to pursue.58 Of course, just two years after Angell’s book was published, Europe found itself in the midst of the Great War. Although this put a damper on economically based theories of peace, it did not stop them altogether. In fact, just a year after the end of World War I, seeking to absolve capitalism from blame for the conflict, Joseph Schumpeter detailed a new version of this theory based on industrialization. Schumpeter proposed a two-stage movement wherein a shift to an industrial mode of production changes society and causes it to become “inevitably democratized, individualized, and rationalized.”59 This in turn influences a state’s leadership to become economically oriented, focusing on profit seeking behaviors as well as anti-imperialist in policy. Finally, these new attitudes are filtered to the mass public who become consumed with the new means of production leaving little time and energy for the activities of war.60 Some modern scholars have tested Schumpeter’s theory that industrialization has induced peace with success. J. Tyson Chatagnier and Emanuele Castelli expand on Schumpeter’s basic thesis by distinguishing between countries with more advanced, industrial systems (those that are heavy in manufacturing and industry) versus countries that are resource rich. In finding that states with larger industrial sectors are less prone to conflict, they argue that the industrialization hypothesis provides an advantage in that the ownership of the means of production becomes irrelevant. In other words, a theory of peace based on industrialization need not depend on whether a country has a free market or a centrally planned economy.61

While Schumpter tries to place the blame for World War I elsewhere, later writers have argued that World War I was either an aberration that should not automatically invalidate trading theories or have interpreted it through a different lens. Gartzke and Yonatan Lupu, for example, doubt the conventional wisdom that “World War I constituted a failure of economic integration to maintain peace” by making three points.62 One, the beginning of the twentieth century witnessed a series of crises among interdependent states in Western Europe which did not result in open conflict. Two, World War I actually began among the less interdependent powers of Austria-Hungary and Serbia. And three, “during the same period in which the highly interdependent European powers were generally able to resolve their crises without resorting to war, the less interdependent powers were typically unable to do so.”63 While not denying that World War I did occur and conflict did break out between interdependent states, Gartzke and Lupu argue that the role of trade has been misunderstood. Similarly, McDonald, who has found that free trade discourages conflict more than trade in general, believes that it was the lack of free trade in the run up to World War I that helps to explain conflict even among trade interdependent countries.64

Though World War I may not necessarily invalidate economic claims to peace, a more general objection is that trade asymmetries can induce conflict through a variety of means. This critique of the economic peace is based on realist international relations theory and the search, by states, for power. Realists have argued that, “Symmetrical ties may promote peace, but asymmetrical dependence creates tensions that may manifest themselves in conflict.”65 In short, if state A is more dependent on trade with state B than state B is dependent on state A, state B holds more power in the relationship. This could influence state A to try to reassert power in the relationship or gain more power, enhancing the chance for conflict. Keohane and Nye, in their study of interdependence, add power to this perspective, arguing that asymmetrical interdependence can be a source of power for the state that is less dependent.66 Further, the more interdependent or connected states are with one another, the more opportunities there will be for states to come into conflict with one another; according to the realist school, conflict is just as likely to emerge from these encounters as cooperation, particularly given their perspective on the nature of states.67

Some research has supported the argument that asymmetrical dependence can increase conflict. James Morrow argues that trade asymmetry might lead to conflict if one state valued the trade more than the other; even if an asymmetry exists, the weaker state in the relationship might not value it as highly as another.68 As such, his analysis finds the effect of trade on conflict to be rather indeterminate. Interestingly, Hans Dorussen, in developing a model of the effects of trade, argues that trade does reduce conflict but the effect actually diminishes as more countries are involved in a trading network.69 Though the model is not tested, his analysis implies that as more countries become interconnected, trade disruptions due to conflict could be made up elsewhere. Gartzke and Li’s findings support this with empirical results that show asymmetry does not contribute to a greater chance of conflict.70

Dale C. Copeland attempts to reconcile both of these objections, the occurrence of World War I and realist international relations principles, with economic interdependence through his trade expectations theory.71 Beginning from a realist perspective, Copeland introduces a key moderating variable: a state’s expectations regarding future trade with another state. If a state who is dependent on another state for crucial resources expects that trade to continue in the future, they have no reason to upset the apple cart by engaging in hostilities. On the other hand, if they fear the trade will be curtailed, “the greater the likelihood that it will choose hard-line policies or all-out war.”72 States, however, operate under imperfect information about both the future and another state’s trade intentions; given this, a trade-security dilemma can arise that is similar to an arms race spiral. If a state fears that their trade will be cut off, Copeland argues their best option is to project military strength into the region to “signal not only one’s determination to protect one’s economic access but also one’s military ability to do so.”73 The other state is likely to see this as an aggressive move and take actions to restrict or cut off trade with the first state or respond militarily.

Both Copeland’s theory and realist work on state power are rooted in the assumption that states seek to protect and enlarge their own power. However, there is reason to believe that the assumption itself is incorrect. Not only are there plenty of examples in history where states have cooperated with one another, James Wood Forsyth, Jr. argues that cooperation is possible even in a world that accepts this Hobbesian view of behavior.74 While Forsyth’s work examines great power cooperation in cyberspace, his argument is still plausible in general and, in particular, for space. He writes:

As each new power grows, its dependencies upon the global commons—sea, air, space, and cyber—will intensify. As dependencies intensify, oligopolistic behaviors will result, where the actions of one great power will have a noticeable effect on the rest. Since the great powers share in and are dependent upon the resources of the commons, the security of each great power will be tightly coupled to the security of the commons. Thus the great powers—for no other reason than survival—will inevitably cooperate and share the costs of providing security even if they might prefer not to.75

Certainly, Forsyth is not talking about trade in general, but he does suggest that the rush to assume that states act to protect interests can be overcome in certain circumstances. While it is not my intent here to engage in a debate regarding realist assumptions of international relations, suffice it to say that there is (and likely will continue to be) ongoing debates about the appropriateness of theoretical assumptions.

A final objection to economic peace also contends that trade interdependence and asymmetries can cause conflict but not through an imbalance of power. Rather, increasing reliance on other states and a growing interdependence of economies can cause both internal and external conflict by stoking latent attitudes of nationalism, economic protectionism, and inequality. The recent wave of nationalist and authoritarian beliefs around the globe are instructive, particularly moves by the United Kingdom to leave the European Union (EU). Peter Hall, writing on the origins of Brexit, argues that its roots can be partially tied to the expansion of the EU in 2004 to include eight east-central European states. At the time, the benefits to the UK appeared substantial: a larger free trade zone within Europe provided more markets for UK products. However, it also allowed the movement of more migrants into the UK.76 While the flows of goods and migrants have provided significant economic benefits to Britain, they also stimulated a backlash. “The referendum vote was won on a wave of public anger sweeping through northern cities and countryside left out of the prosperity that integration into a global economy brought to London.”77 Feeling left out of the economic good times and resentful of immigrants to the country, nationalistic attitudes resulted in a vote to leave the EU with the results still uncertain today. Similar attitudes have been expressed by nationalist-oriented leaders in the United States, Hungary, Brazil, and the Philippines.

It is impossible to deny that globalization has had negative effects. The question is whether they can be overcome or even whether the benefits of globalization outweigh the costs. The larger normative questions regarding the nature and scope of globalization are beyond the scope of this book. The point, however, should be that caution is necessary when considering globalization. Though it may have significant benefits, its side effects can be costly especially when those side effects increase the chances of conflict both inside a state and between states.

Taken as a whole, the economic peace hypotheses suggest that increased linkages, whether they be in the form of trade, globalized capital flows, foreign investment, capital markets, or even globalization, have a peaceful influence on the relationships between states. Though states themselves do not engage in trade, they have an incentive to see that their own economies are healthy; because of that, according to this perspective, they avoid potentially dangerous and damaging conflict which could hurt their economy through disrupted trade patterns and flight of investment and capital. In short, the economic costs borne by war are greater than the benefits of war causing rational states to seek peaceful solutions to conflict.

Methodological lessons and challenges for a theory on conflict in space

The economic peace, more so than the democratic peace, is a fruitful starting point in elaborating a theory regarding space-based dependence and conflict. However, it remains a fact that space is a different environment than terrestrial relations as discussed in the previous chapter. Though it is still dominated by the actions of states, the potential hazards of conflict in space are quite different as is the usage of space and the types of connections that states form through it. Therefore, we cannot simply apply one to one an economically based theory of peace to the domain of space without modification.

While this new theory will be developed in the next chapter, the research into the democratic and economic peace theories provides lessons, as well as potential challenges, for a space bound application. First, most democratic and economic peace research has occurred at either the monadic or dyadic levels; that is, scholars have studied whether certain states are more peaceful than others or whether pairs of states are more peaceful than others. Barbieri and Schneider note that, at least as regards the trade-conflict relationship, little empirical work has been done at the systemic level.78 In specifying a space application for one of these theories, then, it is important to specify at what level of analysis the theory is supposed to work. Is it that relationships among states make individual states less conflict prone in space? Is it that state-state relationships are less conflict prone? Or is it that the system itself, the network of relations among states and private actors, is more peaceful?

Since one state’s actions in space can have significant effects across multiple domains (not just as potential dangers to satellites but as disruptors of military, domestic, or economic behaviors on the ground), the theory advanced here is necessarily systematic. It hypothesizes that given increasing dependence of the global economy on space and increasing economic ties between countries, the system of relationships itself will be less conflict prone in the domain of space. This does not mean that the global system will be less conflict prone on earth. Instead, it treats space as a special area whose connections are far more valuable and vulnerable than terrestrial connections lessening the chances for militarized conflict in space. As a system level theory, it also does not distinguish between regime types or market types; democracies and authoritarian states and capitalist and state-run economies alike are theorized to be equally influenced by these connections. Where there might be variation that influences a state’s behavior, it would come in the form of asymmetrical dependence on the global economy and/or space.

The second challenge for a commercial space peace theory is to specifically link state actions to economic influences. While the attempts of scholars to link these two were discussed previously, I argue that space is a unique domain that enhances the relationship of states and private actors in addition to the mechanisms described earlier. In brief, space is unique for two reasons. One, states like the US, even if they could provide their own independent access to space through governmental agencies, typically contract out and procure both the satellite systems and means of transportation. This gives private space actors leverage with states and an ability to potentially influence a state’s actions and policies. Even if the government is directly providing the launch service, as is the case in China and India, among others, they can still be made to feel the economic pressure. For example, in response to the Indian ASAT test, Brian Weeden, a space analyst with the Secure World Foundation, suggested that companies should boycott India’s space launchers in order to register their objections to the test.79 While there is no indication of such boycotts occurring (at least on a large scale), this type of action is consistent with the economic peace hypotheses discussed previously wherein conflictual type action leads to economic penalties that are greater than the benefits of the action. In addition to withdrawing their business from state actors, private space actors in the future could simply refuse to submit proposals for government contracts or limit the types of launches they are willing to undertake. These possibilities only strengthen the connection between private actors and state behaviors.

The second way in which states and business are linked in space is through government support of technology development, particularly in regard to space. In the United States, investment in space activities, whether it be through NASA or the military, has not been undertaken without political motivations. In the early 1960s, following the establishment of NASA and at the height of the space race, NASA invested a significant amount of money and resources in states and congressional districts whose representatives were powerful in Congress. It just so happened that these members hailed predominantly from the South. As a result, NASA centers sprung to life in Florida, Alabama, Texas, and Louisiana. NASA continues to spend billions of dollars a year at these centers which can amount to a significant economic impact, an economic impact which is not lost on members of Congress representing those areas. In many ways, funding of space activities has become a type of distributive or pork barrel policy, dollars which members of Congress pursue to benefit their district.

This relationship is important for our purposes for several reasons. First, it demonstrates that state actors are sensitive to economic concerns, particularly when it impacts major industries. For example, John Logsdon argues that one of the primary reasons then-President Richard Nixon approved the space shuttle was because of its impact on the spaceflight industry of California, a state whose electoral votes he needed to win reelection.80 This helps to reinforce the electoral connection discussed earlier, especially as it relates to states. Second, space-related industries and corporations are likely to have a far greater impact in political decisions than the public. Public opinion polls have routinely found little salience for space in the United States and often, large majorities express the opinion that too much is spent on space exploration in general.81 As a result, Martin Machay and Alan Steinberg find that, in the case of space, industry influence has a much stronger influence on legislative decisions than public opinion.82 Given these extensive connections, the question ultimately becomes whether private actors should be given preeminence in a theory of space-based dependence. I argue that states remain the leading actors in outer space and therefore worthy of focus. My point here is to demonstrate that a link between the state and economic activity is easily made, specifically with regards to space.

A final lesson from this discussion regards a means of testing the theory. Theories of the democratic and economic peace are subject to rigorous empirical testing precisely because there is variation on the dependent variable: conflict, economic, and otherwise. There is no such variation in terms of space. To date, no actual militarized conflict has taken place in outer space. Testing the theory then, would require the explanation of an event that has yet to take place. Timothy J. Junio and Thomas G. Mahnken call such scenarios future counterfactuals and argue that they are necessary to deal with “high consequence, low probability events” much like a conflict in space.83 Counterfactual accounts usually consist of what if questions, particularly about past cases or circumstances but future counterfactuals, according to Junio and Mahnken, are what if statements about the future. Counterfactuals in general have been “woefully underutilized” in political science.84 James D. Fearon explains this absence as caused by a general feeling that “empirical political science must deal only with actual cases.”85 However, when there are no actual cases of conflict, statistical analysis or even small-N research is not possible. In a survey of uses of counterfactuals and scenarios, Junio and Mahnken find that, when they were used, future counterfactuals consisted of narratives about future warfare—exactly the type of event under consideration here. They further find future counterfactuals to be useful in theory building and development especially for what they call “data poor” research topics.86 While the future counterfactual will be used here to think about the ramifications of conflict in space, it is important to make clear that, unlike tests of the democratic and economic peace hypotheses which are quite voluminous, it is not possible to test this theory in the same manner or to the same degree.

While this chapter has explored the democratic and, importantly, economic peace hypotheses, these ideas only lay the groundwork for the commercial space peace theory. The following chapter will more clearly define key concepts, lay out main assumptions, and detail the main propositions of the theory. Following this, the remaining chapters will take up key elements of the theory including implications and the possible benefits stemming from competition in space.

[\*\*\*FOOTNOTES OMITTED\*\*\*]

Chapter 4: The commercial space peace

Space is often referred to as a global commons which suggests that space is a resource which all actors have access to and can benefit from, also known as a common pool resource or CPR global commons.1 It also means that it is subject to abuse by states whose overuse of it can ruin the common for everyone else. Although describing cyberspace, James Wood Forsyth, Jr.’s description of the problem associated with the commons can also be applied to space:

[C]yberspace is a common property resource—which is to say, no one can be excluded from it. When exclusion is not an option, states have little incentive to pay for a good. Instead, they prefer to be free riders, enjoying the benefits of a good without paying for it. In such a world, overexploitation is the problem.2

Space is experiencing a similar situation. More states and private actors than ever before are utilizing it, there is a growing threat of dangerous debris, and policy coordination is severely lacking. “As a result,” writes Laura Grego, “challenges to stability and security are growing, with ever more satellites and few restrictions on behavior, increasing the risks of costly accidents and of misunderstanding that could lead to conflicts on the ground.”3

This understanding of space as a global commons is derived from work on the tragedy of the commons. The tragedy of the commons, developed by Garrett Hardin in 1968, describes a scenario in which a common resource is depleted over time because of excessive individual use. Hardin uses the metaphor of a common herding area where individuals bring their animals to graze. If the commons can support 100 head of cattle, then ten individuals can each have ten cows. However, one (or more) of the herders may find it entirely rational to add just one additional cow to their herd in order to gain a competitive advantage over the others. If every herder did the same, the resources of the commons would be quickly lost due to overuse. In terms of space, the physical area around the earth is finite. Space is not only a resource that is held in common, no state or entity can claim sovereignty under current space law, but it is also one that can be easily depleted. While this might not have been a major challenge when only a small number of states could access space, the explosion of users of space has complicated matters significantly.

Though there is a debate to be had about whether space qualifies as a commons, assume for the moment that it is. The problem confronting us, then, is how to induce cooperation among actors so that no one actor or set of actors spoils the commons for everyone else. Both political scientists and economists have long recognized the issues surrounding the commons and this type of collective action. Elinor Ostrom, a Nobel Prize winner for her work in this area, examines why some groups do form to solve collective action problems and succeed whereas others do not. Ostrom contends that previous answers to these types of problems ignore the transaction and information costs that can be quite substantial for potential participants and could mitigate any collective action on their part. In turn, she proposes eight principles that contribute to cooperative arrangements to solve collective action problems, including defining clear group boundaries, ensuring those that are affected by the rules participate in modifying them, and providing easy means for dispute resolution, among others.4 These principles suggest that collective action is possible if the members of the group are empowered to create the system in which they are expected to work, can modify the institution as needed, and if the cost of obtaining information and monitoring the common resource is kept low.

Joan Johnson-Freese and Brian Weeden have specifically examined whether some of these principles would be applicable in the management of space as a common pool resource.5 Drawing on Ostrom’s ideas, their “mixed conclusions” are that there are significant caveats, inefficiencies, and disagreements on all sides. They suggest that a tiered system of space users (spacefaring states, space-capable states, and space users) that does not operate based on consensus as the most workable outcome. However, this solution, no matter its format, rules, or procedures, presumes that users of space, whether they are states or private actors, are willing and able to cooperate. Recent history has shown that not to be the case. For example, various countries and non-governmental organizations have proposed new treaty agreements or codes of conduct, but states including the United States have been hesitant to engage on these issues. In 2016, the US withdrew from negotiations on a non-binding International Code of Conduct for Outer Space Activities because of a desire to include a reference to “the inherent right of self-defense in space.”6 Another proposal by China and Russia through the United Nations Committee on Disarmament to ban the placement of weapons in space has faced resistance from Australia, Canada, France, and the United States because of a lack of verification mechanism.7

There does not seem to be high hopes for a formal, or informal, update to the Outer Space Treaty in the near future, but I argue that such an agreement is not necessary to limit the potential for open conflict in space. Instead, all of the mechanisms through which restraint can be found are already present: multiple users, both state and non-state; significant and increasing dependence on space for economic transactions; monitoring; and the danger of cascading effects should conflict emerge are just as capable of reducing, if not preventing, conflict in space. This chapter draws on the findings of the economic peace literature to develop just such a theory. Before outlining its premises, this chapter first discusses key definitions including what is meant by conflict in space. It then lays out the basic assumptions including states as the key actors and rational behavior, common assumptions across various theories of international relations. Then, I make five theoretical claims which constitute the body of the theory. Finally, I explore some of the initial implications that will be taken up in the remainder of the book.

Key concepts

When the term conflict is used, it can be used to define various stages of tension between actors ranging from mild disputes or disagreements to outright war. Part of the methodological tension in the democratic and economic peace literature has arisen from disagreements on the precise meanings and measurements of conflict. If a scholar has a lower bar for what can be termed “conflict,” then there will likely be more of it across the data set. However, if another sets a higher bar, the variation in the amount of conflict will likely be less. While there are no actual cases of conflict yet in space, the meaning of this term for the purposes of this argument is important. Conflict, “a sharp disagreement or collision in interests between two or more actors,” occurs quite often between states involved in space activities.8 Many countries have strongly objected to the Chinese, American, and Indian ASAT tests and there is certainly conflict among states over possible new treaties, agreements, and codes of conduct for space. This does not mean there is a militarized dispute or that conflict will ultimately result in one. Conflict happens. This theory does not argue that increased economic ties to space and increased state ties to the global economy will reduce conflict overall. Instead, the dependent variable of interest here is militarized conflict in space.

The qualification that the conflict occur in space is important; space is a unique domain with its own set of physical rules as detailed in Chapter 2. These differences make space a particularly harsh and unforgiving environment for both people and conflict.9 The environment also increases the costs of engaging in militarized conflict in space. In other words, the costs and benefits of engaging in militarized action on earth are quite different than the costs and benefits of engaging in militarized action in space.

A second reason why the addendum of in space is important is because conflict over space issues or space-based assets could be borne out on earth rather than in space. It is easy to imagine a scenario where one space power, concerned about how another state may utilize space or assets in orbit, might attack one or more of these terrestrial facilities. Spoofing, jamming, and hacking of the signals moving between the earth and various satellites has already happened and will likely happen again. However, should this occur, it would not fall under the rubric of this theory because states would be considering a different set of costs and benefits than if they were carrying out an attack in the environment of space.10

This discussion highlights another distinction, noted in Chapter 1, that should be reiterated here. Weaponization of space is different than the militarization of space. Because of the dual-use nature of space, space has already been militarized. Intercontinental ballistic missiles (ICBMs) travel through the lower reaches of space to reach their targets. Interceptor missiles designed to protect from ICBMs do as well. GPS systems are used to locate hostile targets and guide missiles to their intended targets. There is an argument to be made that the use of such space systems is not peaceful thereby breaking the Outer Space Treaty which preserves space for peaceful uses only. However, the uses of space noted previously are passive rather than active. The systems themselves are not weapons but are used to assist military services. This coincides with the US’s historical understanding of “peaceful” in the OST to mean “non-aggressive.11 In engaging in active conflict in the space environment, a line would be crossed from the militarization of space to the weaponization of space or the use of active, aggressive weaponry in space. More importantly, it does not necessarily matter, at least for the purposes of this theory, whether such use is offensive or defensive. Defensive militarized action is still militarized action that will come with the same consequences as offensive action, at least as regards debris and the potential for damaging cascades of it.

One final concept requires clarification before examining the theory and that is the idea of dependence. As will be shortly argued, to the extent that countries are dependent or interdependent on the global economy and the global economy is dependent on space, the risk of conflict should be lessened. But what does it mean to be dependent? Interdependence, according to Robert O. Keohane and Joseph S. Nye, is state of mutual dependence.12 Although the utilization of space to its fullest is somewhat dependent on the economy (good economic times means more spending and more innovation), we cannot say that space itself is completely dependent on the economy. Therefore, the term dependence is more appropriate in talking about the relationship between space and the economy. Interdependence is the more appropriate term in terms of the relationship between states and the global economy. As discussed in the previous chapter, interdependence has two faces, vulnerability and sensitivity. While I will discuss the interdependence of states and the global economy in what follows, suffice it to say at this point that the concept of interdependence, as defined by Keohane and Nye, will be used to describe relationships between states and the economy.

Assumptions

There are two main assumptions to the theory: one, that states are the central players and two, that they are rational actors. Since these are often taken for granted in the international relations literature, it hardly seems necessary to lay them out here. However, space is a significantly different environment with a growing number of non-state actors. Given the activities of companies like SpaceX or Blue Origin, can it still properly be said that states are the central players? This question mirrors similar ones about the role of the state in both a system of growing globalization as well as in a related domain, cyberspace. In terms of the impact of globalization, the argument is that as state economies are increasingly subsumed by the international economy, states will have less power to determine, at a minimum, economic outcomes. Paul Hirst and Grahame Thompson summarize this argument:

Nation states in this new perspective have become the local authorities of the global system. They can no longer independently affect the level of economic activity or employment within their territories; rather, that is dictated by the choices of internationally mobile capital.13

Lester C. Thurow even makes the bold prediction that many countries will not exist several decades from now because in a world where “countries need corporations more than corporations need countries, the relative bargaining power of governments and multinational corporations is shifting in favor of corporations.”14 Lindy Newlove-Eriksson and Johan Eriksson make the direct argument that space is increasingly “characterized by strong indicators of globalization” and that private authorities are growing in preeminence and power.15

Despite the predictions, however, states are still the main players on the international stage and fully in charge of their economic futures. As was pointed out in the previous chapter, some research shows the globalization and increases in trading relationships can have backlash effects that cause conflict rather than reduce it. As states begin to be tied to one another, internally, those who have been left out of the economic benefits create rising tides of nationalism contributing to political pressure that limits international involvement and acts to implement protectionist policies. The rise of conservative populist leaders in the United States, Europe, and South America is just one example of this phenomenon.16 Such actions only serve to reinforce the role of the state.

Another line of argument regarding the place of the state has been made in terms of cyberspace where the cost of entry is far lower and access more widely available. As information becomes a major source of power, some theorists have argued that increasing internationalization and privatization in the realm of cyber diminishes the importance of the state.17 Daniel Drezner argues that even in such a situation, “States, particularly the great powers, remain the primary actors for handling the social and political externalities created by globalization and the Internet.”18 Similarly, although there has been a proliferation of non-state actors in cyberspace, Hamoud Salhi notes that states still have the “sole ownership of the legitimate use of force.”19 Drezner, too, recognizes a growing role for both peripheral state powers and non-state actors in cyberspace but finds that their influence is mostly marginal.20 In terms of actual conflict in cyberspace or cyberwar, Erik Gartzke argues that the influence of states is actually reinforced—while non-state actors may be able to disrupt, temporarily, the actions of states in cyberspace, unless those attacks are backed up by terrestrial force, they are likely to be merely temporary distractions that states will soon overcome.21

All of these arguments about the centrality of states to cyberspace can also be applied to space. States, having the sole legitimate use of power and far more resources than private companies, have the capability of regulating space activity, particularly launches as well as pressing any military advantages that space may offer. Private actors may engage in hostilities in space, but states can prevent potentially lethal systems from launching in the first place and unless the private actor has a way to take advantage of a space attack through ground attacks, they likely receive no benefit. Further, under international law, states are held responsible for the actions of their nationals in outer space. Henry R. Hertzfeld writes, “it will be difficult, if not impossible, for a company to operate in space without supervision” and, as a result, “unless the major legal tenets of space activity change, commercial interests will be subservient to national interest in space.”22 Therefore, though the number of private players is growing and they play a significant role in preserving peace in space, it is still appropriate to treat states as the main actors in the space domain.

The second assumption is that states behave as rational actors in the global sphere, that is, they make decisions that are consistent with what they believe to be in their national interest. Often glossed over, the assumption that states act rationally is itself based on the assumption that states have correctly identified their own selfinterest and can correctly identify the best means by which that can be achieved. This implies a world of perfect information; without it, misperceptions can run rampant.23 This also assumes that states act in a coherent manner and yet, there are many actors within a state, each of which may have different ideas about the national interest and how it is best achieved. These caveats add a certain number of wrinkles to the idea that states are both unitary and rational actors, but theories must necessarily include simplified abstractions such as these to achieve parsimonious explanation. All of this is to say that states may, and indeed do, make miscalculations as to the national interest, thereby straining the bounds of rationality. It is my argument that states behaving rationally will not see benefit in engaging in conflict in outer space because of its potential costs. It does not rule out that rogue states might take the opposite tact.

Theoretical premises

This section introduces five theoretical premises on which a space economic peace is built. They are:

1 States are interested in promoting economic success.

2 The global economy is increasingly dependent on space.

3 State economic success is increasingly dependent on space to the extent that a state’s economy is integrated with the larger, global economy.

4 The more dependent on space the economy is, the greater economic costs of conflict in space.

5 In considering conflict in space, states have to consider danger to space-based assets and possible economic costs. The benefits of attacking a satellite or other asset have to be greater than the economic consequences that could possibly arise.

The theory suggests that the more dependent the global economy is on space, the chances of conflict are decreased because the economic costs of engaging in conflict are simply too high. The unique nature of space adds to these high costs, amplifying the peaceful effects that increased commercial ties have on the ground. To decrease the chances of conflict in space, increased economic and commercial ties between space and the terrestrial economy should be pursued.

With an understanding of the critique often leveled in economic peace research regarding linkages between the state and private economic activity, the first premise is that states are interested in promoting overall economic success. To the extent that a state’s economy is integrated with global markets, then states also have an interest in ensuring that the global economy thrives as well. It is not entirely necessary to specify the specific mechanisms through which this interest works (at least for the purposes of this argument), but it is important to establish that it is plausible that states are interested in a good economy. The previous chapter suggested several causal mechanisms from the economic peace literature that link the economy to the state including the reelection motivation for elected leaders and Bruce Bueno de Mesquita’s and his colleagues’ selectorate theory. In addition to these ideas, there is a long history of government protection of commerce, whether through protection of trading routes (either over land, in the air, or on the sea) or the imposition of tariffs to protect domestic economies. The state would not engage in such costly activities if it was not concerned with economic matters. Purchases of government debt by another country only add another layer to this. For example, as of early 2020, China held $1.1 trillion in US debt, more than a quarter of the American debt held by foreign countries.24 Not only does China influence the US economy through these purchases, it also increases the amount of danger to the Chinese economy (and government) should the US economy decline.

The unique environment of space adds substantial backing to this premise. States that utilize private actors to build their space infrastructure and launch it are dependent on the success of these private actors which, in turn, is partially predicated on the state of the economy overall. Second, heavy state investment in the development of space technologies not only benefits certain states and congressional districts (adding to the weight of the reelection hypothesis) but technological advancement can stimulate the economy directly. Eli Ginzburg, James W. Kuhn, Jerome Schnee, and Boris Yavitz detail several early studies on the economic impact of NASA, including one that found that with each dollar spent on research and development, returned “slightly more than $7.00 in gross national product over the eighteen year period following the expenditure” and that the “$25 billion (in 1958 dollars) spent on civilian space research and development during the 1959–69 period returned $52 billion through 1970 and will continue to produce payoff through 1987, at which time the total gain will have been $181 billion.”25 A 2013 report finds that the agency develops 1,600 new technologies per year, all of which are transferred to industry and for “every dollar NASA spends on employees, businesses, universities, and others generates $2.60 of output in the economy, as compared to the federal non-military average of $2.30 and the federal military average of $2.00.”26

Admittedly, demonstrating that government investment in space technology impacts the general economy is not the same as demonstrating the government has an interest directly in the economy. However, spending on space is routinely justified by government officials precisely because it is a net positive to the economy.27 In the United States, this justification began early. In April 1963, in response to a request from President John F. Kennedy to review NASA’s budget, Vice President Lyndon B. Johnson justified the spending on space largely in economic terms, writing,

It cannot be questioned that billions of dollars directed into research and development in an orderly and thoughtful manner will have significant effect upon our national economy. No formula has been found which attributes specific dollar values to each of these areas of anticipated developments, however, the “multiplier” of space research and development will augment our economic strength, our peaceful posture, and our standard of living.28

More recently, in a March 2019 announcement tasking NASA to return to the moon by 2024, Vice President Mike Pence invoked economic rationales several times to justify the project:

The United States must remain first in space, in this century as in the last, not just to propel our economy and secure our nation, but above all because the rules and values of space, like every great frontier, will be written by those who have the courage to get there first and the commitment to stay.29

This justification of space development in terms of its economic potential is not limited to the United States. Both Russia and China have concerned themselves with the economic and commercial potentials of their space programs.30 The Chinese government in particular has emphasized the commercial applications of its launch systems since it entered the global launch market in the 1980s. For China, space development is not just a means of enhancing their economy but also of connecting their disparate population centers with outlying areas and of further supporting space development.31 If politicians are supporting space funding, even in part, because they believe it benefits the economy, then this first premise, that states are interested in a successful economy, is more than plausible.

The second premise of a space economic peace is that the global economy is increasingly dependent on space. Chapter 2 outlined some of the many ways in which space-based instruments contribute directly to economic activities including satellite television, radio, and communications, imaging, weather forecasting, satellite imagery, and location services. Satellites also serve as a means of transmitting economic data and information and facilitating exchange and economic transactions. Given the wide use of space-based assets, there is little agreement on measures of economic impact and even fewer of the extent to which the global economy relies on space. That being said, at the end of 2018, the global space economy was worth approximately $400 billion, 80% of which was commercial activity.32

To my knowledge, the only comprehensive study addressing this question economically was undertaken in 2018 by the European Commission. In assessing this question, the Commission differentiated between direct dependence, indirect dependence, and peripheral dependence on space-based assets and its findings are stunning. In terms of direct dependence,

[T]he size of the European downstream market is estimated to be in the order of EUR 40.7 billion of revenues per year, yielding a G[ross] V[alue] A[dded] in the order of EUR 21.1 billion. This represents around 0.16% of the total European GDP. Although this may seem low, the sector is actually more than three times as large as the fishing and aquaculture sector in economic terms and comparable to the passenger rail transport or forestry and logging sectors. In the event of a loss of space assets, the complete dependence of this sector would lead to a total loss of revenues for European companies involved in this market. A complete loss of assets would also impact the 200 000 jobs in the European space downstream sector.33

Further, the report identifies 11 macro-sectors that are indirectly dependent on space whose space dependent activities represent 786.9 billion euros of annual gross value added.34 For context, that approximates just over $887 billion. When considering the full impact of a loss of space assets on the European economy, between 300 and 800,000 jobs would be at risk with significant losses both socially and strategically as well. The report concludes that such dependence can only be expected to grow.35

It is clear from this report that the EU’s economy is significantly dependent on space-based assets. Assume for the moment that, in the event of a major loss of space infrastructure, only the EU was affected. While this is certainly implausible, even if the EU were the only ones affected, the consequences would no doubt ripple through the global economy quite quickly. Further, even if some states are less dependent on space assets than the EU, the United States, or other major powers, they would likely still experience economic interruptions depending on how integrated they are into the global market.

One specific area of space dependence that has direct economic impact is the Global Positioning System or GPS. Though some backups exist, if GPS were disrupted, many economic and financial transactions would be immediately disrupted.36 We can consider the global economy’s dependence on GPS through Keohane and Nye’s two facets of interdependence, vulnerability and sensitivity. “Sensitivity is the extent to which one country is affected by the actions of another, whereas vulnerability is the extent to which a country can insulate itself from the costly effects of events that occur elsewhere.”37 In terms of sensitivity, we can ask how quickly would disruptions in GPS affect the economy and at what cost? In January of 2016, the US Air Force, as it was taking one of the 31 GPS satellites offline, introduced a tiny error of 13 millionths of a second into the timing system. The error immediately disrupted GPS-based systems around the world for more than 12 hours. “In parts of the US and Canada, police, fire, and EMS radio equipment stopped functioning. BBC digital radio was out for two days in many areas, and the anomaly was even detected in electrical power grids.”38 The error was eventually fixed, but it took no time at all for its consequences to be felt. And that was a situation in which there was no loss of an actual satellite or satellites.

As for vulnerability, we may consider whether there are alternatives/options to GPS that can quickly take over in the event of a change in space. Though the EU is completing its Galileo system and Russia has its GLONASS system, neither are as dependable or widely available as GPS.39 It is fairly safe to accept the premise that the global economy is dependent on GPS specifically and space more generally. And that dependence is only growing.

The third premise of the commercial space peace theory is that state economic success is increasingly dependent on space to the extent that a state is enmeshed in the global economy. Because a state’s economy is, at a minimum, interconnected and at maximum, highly interdependent with the global economy and because the global economy depends on space, then a state’s economy is dependent on space too. It is well known from empirical findings that state economies are increasingly enmeshed in the global economy. Globalization has been variously measured in studies via levels of trade, foreign direct investment, and foreign portfolio investment. Given that it is a multidimensional concept, Axel Dreher introduced a composite index of globalization, the KOF, in 2006 that has now become the most widely used globalization measure when studying economic globalization.40 The KOF index looks at what the authors call de facto and de jure globalization: “While de facto globalization measures actual international flows and activities, de jure globalization measures policies and conditions that, in principle, enable, facilitate and foster flows and activities.”41 Figure 4.1 displays the global KOF de jure and de facto indices from 1970 to 2017. There is no mistaking a rapid increase in both types, particularly following the end of the Cold War, though it has leveled off some in recent years.

To be sure, globalization, particularly in relationship to space, is not inevitable and comes with significant costs. Hertzfeld notes that regulatory limits put in place by states to prevent unfriendly states from acquiring certain types of technology (for example the International Traffic in Arms Regulations enforced by the United States) limit the degree of international trade.42 Further, if security and defense issues continue to increase in importance, it could “easily lead to a decline in market-based commercial space applications as government demands and regulations supplant the development of private markets.”43 Other negative externalities associated with globalization might also play a role in restricting its growth, including internal conflict spurred on by economic losses in some segments, a backlash to international trade, and an increase in general trade barriers. However, global dependence on space does not appear to be ebbing any time soon and Hertzfeld even acknowledges that such trends are unlikely to be deterred. Thus, we should expect to see the global market increase its dependence on space for the foreseeable future.

[\*\*\*FIGURE OMITTED\*\*\*]

The fourth premise proposes that the more dependent on space the economy (global or state-based) is, the greater the economic costs of conflict in space. To understand why this might be the case, consider a scenario where only a state’s military space assets are targeted with no collateral damage. Even though scholars and military analysts recognize the immense dependence of many military forces on space resources, assume also that militaries have redundancies and workarounds so that destruction of one asset does not cripple their capabilities. In that case, the costs of conflict are not sufficiently high so as to dissuade the countries from engagement. However, even if only a military target was engaged, there is no way to ensure that the debris created in the attack will have no further threat to other assets, military or otherwise. Uncontrolled debris could easily impact with other satellites on which economic activities depend initiating a Kessler syndrome-type cascade. And unlike the military, the global economy does not have sufficient backups and workarounds to compensate for the loss of a satellite or satellites. Roger Handberg, in examining the assumptions of space war writes: “Globalization has been fostered through satellite technologies. Their disruption can be devastating for all parties, regardless of who is the winner or the loser.”44 The implications of this are catastrophic. No satellite or space-based asset would be protected, and the resulting debris field could make usage of particular earth orbits impossible for both public and military uses. Attacking another country’s satellite comes with the possibility of harming your own.

Closely related to this premise is the final one which states that as countries contemplate militarized conflict in space, they must consider the possible economic costs of their actions. States should only engage in conflict where the potential benefits outweigh the costs. As the cost of conflict in space rises, states should be less likely to find the attack to their benefit. And the more the economy is dependent on space, the higher the costs are likely to be. Handberg puts the situation quite bluntly: “What may occur is the graveyard of the modern economic system. No potential space participants would be immune to the damage, regardless of whether or not they were participants in the actual conflict.”45 This idea is nothing different than what is argued in the trading variant of the economic peace literature: the benefits of conflict have to be greater than potential economic costs. What is different here is the causal mechanism—rather than conflict mediation through the trading relationships between states, it is the network of relationships between space, the economy, and states that increase costs beyond the potential benefits.

One objection to this argument is similar to the critique that states do not engage in economic activity: perhaps economic costs are not factored into military planning. Some analysts may argue that if a state’s security is at risk, economics be damned; the state should pursue all avenues to increase its power and security. However, economic power not only influences other states but serves as the foundation for military capabilities. For example, Alfred Mahan, who significantly influenced theories on maritime power with his writings in the late nineteenth century, argued, “a nation that could protect its own maritime commerce while disrupting that of its opponent could shift the balance of national resources decisively in its favor.”46 The US military’s Joint Planning doctrine published in 2017 explicitly recognizes a discussion of costs and benefits when planning operational activities.

Joint planning identifies military options the President can integrate with other instruments of national power (diplomatic, economic, informational) to achieve those national objectives. In the process, joint planning identifies likely benefits, costs, and risks associated with proposed military options.47

If attacks in space harm the economy, these costs and risks, according to US military doctrine, will be, at a minimum, considered; it is the argument here that they will likely outweigh the benefits of such a course of action. Thus, for states that are heavily dependent on space, whether directly or indirectly through their ties to the global economy, the potential economic costs of engaging in a militarized conflict in space should be high enough to dissuade them from pursuing such courses of action.

Like the empirical findings on trade, another similar counterargument can be made against the pacific effects of trade and increased dependence on space: asymmetrical dependence could be just as likely to increase the chances of conflict.48 The states that are heavily dependent on space are also major powers like the US, Russia, China, and India, all of whom have demonstrated the capability of using anti-satellite weapons. Given each of those states’ reliance on space and the global economy, the benefits of conflict should be less than the potential costs of conflict. But what about states who are less dependent on space, either directly or indirectly? It is possible that they see this decision calculus differently and believe that the benefits of conflict are greater than the costs. These states are also likely to be weaker militarily to begin with. Like Erik Gartzke notes in terms of attacks on cyber space, an attack, whether it be in space or in cyberspace, would not be meaningful unless paired with a terrestrial attack as well.49 Whatever advantage a less space-dependent state gains from an attack on a space asset is likely to be minimal, temporary, and lead to no further advantage in the long term.

To illustrate the point, imagine a scenario where a less space-dependent state like North Korea, Iran, or even a terrorist organization manages to launch a physical attack on a key American military satellite. While there are most likely ways for the US military to work around such an attack (transmissions could be sent through another satellite or uncrewed aerial vehicles), the US would also likely strike back. If the attacking state is really less dependent on space, there will be fewer spacebased assets on which a retaliatory strike could take place. Given the lack of space assets to attack, the US might consider one of two options: a land-based attack or a space-based attack on a state that supports the original instigator. For example, in the case of North Korea, the US might consider an attack on a Chinese space asset while for Iran, it could be Russia. If the US chose the first option, again, North Korea or Iran would have to be aware that they would be quickly overwhelmed. If the US chose the second option, they would need to consider the potential for collateral damage that could end up harming the United States to a far greater extent economically rather than just militarily as well as the costs of dangerous escalation among space powers.

Finally, given the involvement of an ever-larger number of private actors in space, states also need to consider the lost opportunity costs if private actors choose to forego research, development, and deployment of new technologies because the danger in space is too high. As space becomes more commercialized, these private actors can exert pressure on states to behave peacefully in order to promote further economic development. Gartzke and Quan Li argue that this can happen through the movement of capital from conflict-prone states or areas to non-conflictual states.50 This is not necessarily applicable to space because there is no area in space which is formally protected, but commercial space actors may choose not to engage in new economic investment which can in turn affect a state’s economic performance. To date, the size of the space sector is comparatively small, so, arguably, the potential economic loss would not be that great. Where the harm comes from is state reliance on private actors for military and national security space services. As states contract out space services to a greater extent, private actors exert an even greater influence over the state by having a capability they do not.

Why might private companies want a more conflict-free space? If there is weaponized conflict in space, they could potentially benefit through new launches to send up replacement satellites; this is similar to an argument that war can actually be beneficial to an economy because companies are needed to create materiel and weapons.51 But, in a debris filled environment, sending replacements is more difficult and dangerous. Some private companies want to engage in human spaceflight; a conflictual or more dangerous orbital environment would likely prevent those activities or increase their costs to such an extent that it becomes economically infeasible. James Clay Moltz argues specifically that “the growing presence of space tourists in low-Earth orbit would greatly increase the incentives for restraint in any future [ASAT] test programs.”52 Those foregone development costs and commercial activities can have a similar cost to states simply by discouraging private actors from participating in the market.

Implications

While the theory described previously is based on the economic peace literature, it is not the economic relationships among states that lead to peace in space, rather, it is the global economy’s dependence on space that does. This idea is not as farfetched as it may seem. Following the immense amount of debris generated by China’s ASAT test in 2007, there has been a growing acceptance that such tests should be avoided in the future precisely because the increase in debris makes operations in space, both peaceful and militarized, more difficult. Shortly after India’s March 2019 test, US Air Force General John Hyten warned a Senate committee that there is increasing danger from space junk, saying,

If we keep creating debris in space, eventually we are going to get to the point where it’s very difficult to find a place to launch, very difficult to find a place to put a satellite, to operate a satellite without having to maneuver it all the time to keep it away from debris.53

While Gen. Hyten was speaking specifically in reference to military needs, the same restrictions would also apply to commercial space assets.

Thus, the major implication of this theory is that the more dependent a state is on space, whether economically or militarily, the lower the chances of that state initiating or becoming involved in a military conflict in space. Granted, the theory does not address military dependence specifically, but that too, is increasing. As early as the mid-1990s, Jeffrey Caton described the US military’s dependence on space and wrote that,

An attack on our space assets could impact every element of national power— political, diplomatic, economic, and military. . . . An enemy has much to gain by exploiting the dependency link between our terrestrial forces and forceenhancing space systems.54

The point, however, is that space is not just used for military purposes—if it was, the chances of conflict are likely far higher. The fact that there is a significant economic use for space restricts choices in space militarily because of the economic impact of the conflict.

This theory also does not rule out the weaponization of space or the deployment of weapons whether offensive or defensive in nature. It does argue, however, that they should not be used. The danger, of course, is that any sort of weaponization of space could increase tension and contribute to a growing arms race in space, something that will be discussed further in the next chapter. Writing on the attitudes of the Americans and Soviets at the high point of the Cold War, Steer argues that “the unique nature of the environment meant that weaponization could endanger each state’s own sovereign interests as much as any adversaries.”55 In analyzing today’s strategic environment, Johnson-Freese echoes the argument:

[W]hile space weapons might offer the United States a short-term advantage, in the long term they would actually weaken US security by instigating an arms race that cannot be won, by anyone. Further, space weapons could potentially provoke a first strike by an adversary, create a “use it or lose it” mentality among US forces, and risk rapid and dangerous—perhaps even nuclear—escalation.56

Weaponization will likely stimulate a space arms race but to the extent that a state is rational and interested in reducing and mitigating potential economic, weaponization should still be avoided.

This theory also does not rule out other motivations for reducing conflict in space, including the limitation of a potential opponents use of space through diplomatic means. This would follow a pattern established during the Cold War where

Following a series of arms tests in space, both the United States and the USSR realized that if they wanted to continue to have access to space for intelligence, reconnaissance, and surveillance purposes, they would need to come to some compromises as to its use.57

The resulting diplomatic outburst produced not just the Outer Space Treaty, which banned the placement of nuclear weapons in orbit, but the Agreement on the Rescue of Astronauts, the Convention on the International Liability for Damage Caused by Space Objects, and the Convention on Registration of Objects Launched into Outer Space. In other words, economic concerns can serve to restrict military conflict in space with other concerns, including diplomatic, reinforcing the effect, further reducing the chances of conflict.

As described at the beginning of this chapter, while work on codes of conduct for space or new international agreements is ongoing, to this point, there does not appear to be any momentum to conclude any such talks. It is possible that major space states could suddenly realize the impact of their own actions in space and work to reduce tension like the US and Soviet Union did in the late 1960s. However, should that not be the case, this theory suggests that an international regulatory framework or code of conduct is not absolutely necessary to restrain state behavior. Instead, as commercial and economic dependence on space grows and the space market is encouraged to expand, economic restraints can fill the void until such time that an international agreement becomes feasible. Moltz argues that this option of “muddling through,” or engaging in a piecemeal fashion, could continue, but that it has several significant drawbacks.58 These include a failure to include considerations of national and military power and lack of enforcement against those who violate norms. However, in viewing conflict in space through the theory presented here, the economic realm does not have to take into consideration military concerns as long as economic costs are considered in military planning. And as long as states behave in a rational way, we can assume that they will. States have a strong, rational interest not only in protecting the economic wellbeing of their states but also in increasing their economic standing. As detailed earlier in this chapter, economic considerations are already rooted in American military doctrine. In terms of sanctions for violating norms, they could be carried out through loss of economic activity as the economic peace literature proposes. States who violate acceptable standards of behavior may find space commerce fleeing from their country and a lack of partners who may want to work with them. While “muddling through” might not be the optimal strategy, it is one that has worked to this point.

The value of competition

As noted in the first chapter, a subsidiary argument offered here is that, even if a space race should break out, military or civilian in nature, competition is not necessarily a bad thing. Much of the technological development noted previously that arose from space investment came at the height of the space race as both the US and the USSR were pouring billions of dollars into a race to the moon. The race itself had a civilian face with a military undertone, but its benefits were on the whole, positive. No overt military conflict arose, there was a significant investment in research, development, and technology, and the two space powers realized that they needed some sort of international framework to preserve their ability to operate in space. Both of these elements continue to be present today.

First, the increased threat of conflict in space could, coming as it does with an increased number of public and private actors and a greater economic threat, impress upon space participants the need to reign in dangerous actions and rhetoric. While it took an atmospheric nuclear test on the part of the Soviets to encourage both the US and USSR to come to the table in the 1960s, increasing awareness of economic and military dependence and the consequences arising from conflict in space could increase the enthusiasm to pursue new international agreements. For its part, the US military increasingly recognizes the dangers and the need to mitigate them, however, mitigation efforts have largely concentrated on offensive rather than defensive capabilities.59 A focus on offensive weapons can only aggravate the situation and there are still significant technological hurdles in developing on-orbit offensive weapons. As such, a move away from such rhetoric, like Johnson-Freese argues for, is necessary.

Competition can also increase technological capabilities and those technological capabilities can in turn enable cooperation.60 China is a case in point. In the 1990s and early 2000s when they were beginning to restart a human spaceflight program, Chinese officials often stated their desire to work with other powers in space, particularly the United States. China did in fact forge ties with other countries via space, in particular Brazil. However, as Chinese spaceflight technology advanced, the rhetoric of cooperation was pulled back some over a desire to enter into a partnership on equal footing. Once the Chinese could establish their abilities in space, they would be able to cooperate with potential partners as an equal, rather than junior, partner.61

As more countries develop space technologies, the ability to help one another out also increases. The Agreement on the Rescue of Astronauts obligates signatories to “take all possible steps to rescue and assist astronauts in distress and promptly return them to the launching state.”62 More states with the ability to conduct crewed operations in space will only facilitate this type of help and cooperation. While fictional, this is just the type of scenario that played out in the book (and later movie) The Martian. When a supply rocket blows up on launch, NASA turns to China for a replacement that enables a Mars crew to return to Mars to rescue a stranded astronaut. These types of cooperative activities can in turn foster greater cooperation in areas other than space and science. In fact, one of the causal mechanisms through which the economic peace is hypothesized to act is via increased connections between people and private actors which can foster communication and mutual trust.63 Similarly, sociological liberalism embraces the importance of links among people to create more peaceful global relations.64 As greater cooperation emerges in space, it can spill over into other areas of interstate relations.

To return to the discussion of space as a global commons, the increased competition and potentially increased cooperation could lead to the type of situation that Ostrom finds powerful in fostering collective action. Increased ties, diplomatically and/or economically, can reduce the costs of engaging in collective action. Historically, space itself has been used to monitor and verify international agreements, thereby lowering the information costs for participants. The openness of space and the vulnerability of space infrastructure makes it an arena that is easily monitored; it takes a fairly low level of technology to track satellites in their orbits. States can provide the means through which private actors are coordinated and norms enforced. Private actors, given their increasing role in the commercial and military aspects of space can also be empowered and lend considerable weight to the discussions. Thus, while the commercial space peace theory presented here may seem rather pessimistic about the possibility of cooperation among states, it can also be seen as an optimistic vision where increased economic ties between space and among actors, state and non-state alike, bring countries to the negotiating table and create the conditions needed to ensure collective action.

The remainder of this book will take up various aspects related to this argument. The next chapter examines military and geopolitical considerations in space conflict while Chapter 6 discusses the various actors involved. Chapter 6, in particular, focuses on the new non-state actors that are driving significant change in earth’s relationship to space. Finally, Chapter 7 looks at the possibility of space races in the future given this new space environment with its proliferation of players. It ends with several policy suggestions that could be pursued to reduce the level of tension among space powers and create a scenario that recognizes both the dangers and promises of space.

#### No arms racing or war impact- space war is not inevitable AND interdependence solves

Cobb, 21 -- PhD, Associate Professor Qof Strategy and Security Studies at the SAASS

[Wendy N. Whitman Cobb, SAASS is the School of Advanced Air and Space Studies, received a BA and MA from the University of Central Florida, USA, in Political Science, and a PhD in Political Science from the University of Florida, USA, "Privatizing Peace: How Commerce Can Reduce Conflict in Space," Chapter 5: Is it a trap? Arms races in space, p. 77-93, Routledge, 2021, <https://doi.org/10.4324/9780429321917>, accessed 1-26-22]

This competition has already begun in space, and the United States must decide now what its space policy will be in the face of a clear and present danger. Because the Soviets have assuredly decided to compete in a determined way, we cannot afford the consequences of muddling through in a struggle that could spell disaster.1

The coming war with China will be fought for control of outer space. . . . [T]he unavoidable conclusion is that the United States and the People’s Republic of China (PRC) are on a collision course for war.2

Though written nearly three decades apart, the authors of these passages believe both that a coming war is inevitable and that the United States must begin to prepare for it militarily in space. In the first case, written in 1981, the authors, Dino A. Lorenzini and Charles L. Fox, warn of imminent conflict with the Soviet Union, a conflict we now know never occurred. In the second passage, Everett C. Dolman warns in 2012 that conflict with China is not only unavoidable but possibly already underway. Dolman recognizes that “Inevitability is a crass and unsubtle divination,” but he also argues that “The past foreshadows the future—and the calculation of probability over time, combined with risk, is more persuasive than platitudes.”3 If past is prologue, however, what does the fact that the “inevitable” space war with the Soviet Union never occurred tell us about warnings of an inevitable space war with China? The weight of history may not be on the side of conflict, instead it may be on the side of cooperation and stabilization. In fact, this is the very argument advanced by Cameron Hunter who, in analyzing American archival national security documents, argues that the Chinese space program was seen as a threat at the dawn of the space race by American officials. That this “threat” could be overcome demonstrates that today’s supposed threat from China is instead “politically contingent.”4

While Dolman may be incorrect in his prediction of conflict with China in space, he is certainly correct that history has much to teach us. In the case of space, there have been several periods where analysts and military strategists have believed conflict to be imminent and yet, in each of those periods, space powers have chosen to step back from the breech and discover that cooperative restraint, if not outright cooperation, provides a better path for themselves and for all. The argument that conflict is inevitable demonstrates a sort of fatalistic attitude. Space states have a choice in whether to pursue weaponization of and conflict in space and have chosen not to for reasons of self-interest; to call conflict inevitable is to assume that states do not have a choice and therefore have no power. As will be discussed in what follows, as both the Soviet Union and the United States realized the security advantages that passive space systems for reconnaissance and monitoring granted them, they each became concerned with protecting their ability to operate freely in space. Though doing so out of pure, rational, self-interest, the decisions by the Soviet Union and the US in the mid- to late-1960s protected space from conflict. Since then, not only have states recognized the military advantages that space systems offer, they, and the rest of the world, have recognized and come to rely on the economic advantages of space. Today, as we contemplate yet another period in history where space conflict may appear inevitable, the motivating rational self-interest is not just in the military and security spheres but in the economic.

If we are in a new space race today, as some, including Dolman, have argued, then considering the space race of the past is appropriate. It is not my intention here to review the history of the space race or to even provide a broader historical examination; excellent studies on this topic are available elsewhere.5 What is important for our purposes is understanding what prevented the space race from erupting into conflict in the first place and the lessons that may have for preventing conflict today. My argument here is that although economic consequences did not play a significant role in constraining space-based conflict in the 1960s, the space states of the time, the US and USSR, did consider the costs and benefits of conflict for their own national security strategies. At that time, they came to the conclusion that any open hostility in space had the possibility of inhibiting their own spacebased operations. Today, the basic conclusion remains the same for all states: any open conflict in space has the potential of negatively affecting all states through the global economy. Thus, while the conclusion and the self-interested rationale have not changed, the basis on which the conclusion is drawn has.

Before examining the original space race, this chapter first briefly explores the logic of arms races. To call the space race a “race,” implies a state of competition between entities. This language clearly draws on the concept of arms racing; Lorenzini and Fox and Dolman both explicitly accept that an arms race is ongoing in their respective time periods, whether the US realizes it or not. To say that we are engaged in a space race, then, does not connote just a competition but also one that has a militarized underpinning in the seeking of weaponry or advantages in weaponry. With just one previous space race, it is dangerous to draw generalizable conclusions. Fortunately, general arms races have occurred more frequently and the study of them provides important context for considering a space race. As such, following a brief discussion of arms races in general, this chapter examines restraint in the original space race. Finally, I will consider the possibility of a new space race today. Though a civilian space race does not seem to be developing, there is evidence of a new push to develop military space systems that could be radically destabilizing. However, just as the US and USSR came to believe their actions in the 1960s were destructive of their own ends, space actors and states today can come to the same conclusion and utilize similar strategies to walk back from the brink.

The logic of arms races

The concept of an arms race is an old one. The Greek historian Thucydides recognized the dynamic in the wars between Athens and Sparta: as one powerful nation-state is challenged by a rising one, the established state feels threatened and consequently builds its military force. The emerging state sees this and furthers its capabilities, resulting in the war that was feared. This so-called Thucydides’ trap predicts that the rise of an emerging power necessarily leads to war has also come to be known as an arms race or security dilemma. Colin Gray, writing in 1971, defines an arms race as the following:

[T]here should be two or more parties perceiving themselves to be in an adversary relationship, who are increasing or improving their armaments at a rapid rate and structuring their respective military postures with a general attention to the past, current, and anticipated military and political behavior of the other parties.6

In other words, as country A builds up its arms, whether out of defensive or offensive motivations, country B feels threatened and feels the need to do the same. Country A, seeing the actions of country B, sees continued purpose in their endeavor and the rush to acquire weapons soon leads to out and out conflict.

Despite the attention given to the quantity of armaments, Samuel Huntington proposed in the late 1950s a dichotomy between qualitative and quantitative arms races. Quantitative arms races focus only on the numerical acquisition of arms and qualitative arms races on improvements in military technologies that make a weapons system more advanced than an opponent’s or improve upon the manufacturing techniques used in producing them. Qualitative arms races, in this sense, are just as destabilizing as quantitative—a country’s investment in a revolutionary new weapon that, if even just one was purchased and used, could make all others obsolete, is considered a revolutionary, not evolutionary, military advancement. An example of such a qualitative arms race is the race to understand, design, and build nuclear weaponry during World War II. The race that followed, that concentrated on the number of nuclear weapons, is a quantitative arms race.

With the rise of tensions in the Cold War, understanding the dynamics of arms races became a significant topic for academics in the mid-twentieth century. These scholars moved away from definition to an analysis of motivations and causes. In 1960, Lewis F. Richardson built a mathematical model of this process based on three underlying motivations for an arms race: revenge or hostility, fear, and a tendency to reduce armaments so that they are more economical.7 Far from leading to a state of mutual deterrence based on equal amounts of power, his equations postulated a spiraling tendency to arms races that inevitably lead to war. Coming as it did in the midst of an actual arms race, many scholars found this argument not only credible but persuasive. Michael Wallace, in seeking to quantify the frequency of conflict with arms races finds that arms races escalated to war in 23 out of the 28 cases of war he studied.8 However, in the ensuing academic debate, little evidence was found to support the notion that arms races were early indicators of coming war.

At the same time scholars were testing mathematical models of arms races, game theoretic models were created using the form of the prisoner’s dilemma. These specifically included uncertainty about the actions of an opponent in contributing to arms races. If two states had perfect information about one another—their motivations and capabilities—an arms race is not rational. But in the case of uncertainty, defection (in the form of an arms race) is rational. Andrew Kydd, more recently, hypothesizes that arms races develop when there is uncertainty specifically in regard to the economic ability of the other state to bear the costs of a buildup.9 In this manner, arms races reduce uncertainty about the costs a state is willing to bear along with their military capabilities. Toby J. Rider concurs with the idea but focuses more acutely on uncertainty over the policy positions of a state’s leadership. He finds that arms races are more likely early in a state leader’s tenure, when global uncertainty about them is highest.10

Additional motivations for states to undertake arms races go beyond deterrence and uncertainty. Gray summarizes seven of these including: deterrence, defense, diplomacy, functional threats, vested interests, reputation, or technology development.11 While defense and deterrence are implicit in the previous descriptions, diplomatic motivations find states increasing their arms in order to have a stronger hand at the bargaining table. If other countries believe or perceive a country to have certain capabilities, they may be more willing to engage and conciliate than otherwise apt to. In addition to these external factors, some arms races may be motivated by more domestic and state-based variables. Functional threats have a close relationship to bureaucratic politics in that “domestic institutions seeking to maintain or enlarge their budgetary and influence bases need to enlist or harness the functional hostility of an external rival.”12 In other words, bureaucrats, seeking more money, emphasize the risk or threat from another country in order to pad their budgets and resources. Similarly, vested interests in the form of a country’s defense industry could also push the storyline that the state is threatened in order to increase their bottom line. Joan Johnson-Freese identifies these two dynamics as contributing to the drumbeat for further space weapons development in the United States currently. In Space Warfare in the 21st Century, she writes:

These companies [military-industrial companies including Raytheon, General Dynamics, Boeing, and Lockheed Martin] inherently have a vested interest in maintaining and expanding systems, including weapons systems, which absent clear and direct external threats, may have limited political justification. Additionally, government counterparts to these for-profit companies have concurrently grown—some might say, ‘become bloated’—and in many cases, a codependent relationship has developed between them.13

Thus, bureaucrats working with industry both have an incentive to stoke fears of an adversary so that they benefit from increased budgets and a purpose of mission.

Finally, states may engage in arms races to protect their reputation or for technological gains. Technological improvements, according to Gray, can stimulate arms racing for fear that better technology abroad will make a state’s current technological capacity obsolete. Though it might seem out of place given the previous list of motivations, prestige and reputation can also be a significant motivator to invest in arms. A race for reputation is certainly applicable to the early space race where the launch of Sputnik 1 created a public relations nightmare for the United States. Gabriel Almond, in analyzing the effect the Soviet launch had on global public opinion in 1960, found that America’s reputation was significantly damaged and the “belief in the scientific and technological superiority of the United States rudely shaken.”14 Most, if not all, space historians acknowledge the role that prestige and reputation had in the creation and sustainment of the space race. Even today, the Chinese space program is predicated on the idea that its space successes bring them global credit, recognition, and respect thus sustaining the idea that space races are, at the very least, undergirded by the motivation of prestige.

One might argue at this point that the motivations of an arms race matter little if the end result is war or if they do not lead to conflict as some scholars have argued.15 To this, there are (at least) two answers: One, the underlying causes could lead to different types of races with different outcomes and two, the causes have much to do with possible outcomes. In the first instance, races carried out for prestige purposes or deterrence may not lead to war. In the second, if an arms race occurs in the context of enduring and preestablished rivalry, that pair of states could already be heading for conflict, regardless of an arms race. Charles Glaser argues that scholars must first consider why states undertake arms races and then determine whether it is rational for them to do so.16 If a state’s international security environment is so threatening that an arms race is a rational response, then the arms race did not cause any eventual conflict, the security environment did. If a state undertakes an arms race irrationally, that is in response to a non-threatening security environment, “they make war unnecessarily likely.”17

While more recent research suggests a modest increase in the chance of war as a result of an arms race, it is also clear that arms races are still not associated with most wars.18 Since the space race did not end in a space war, how arms races end is also of interest here. George M. Downs, David M. Rocke, and Randolph M. Siverson contend that

the majority of arms races that have ended in cooperation have done so not because one side adopted a particular cooperative strategy, but because the basic character of the race was altered by events that were not directly connected with it.19

These outside events can include larger changes in the balance of power, the unilateral behavior of another power, or changes in economic circumstances. The economic cost of an arms race can be a powerful limiting factor. Gray writes that when the economic costs of pursuing a military exploitable strategy are so high that they are prohibitive in cost, those arms races can become dampened or “nonself-aggravating.”20 Similarly, John C. Lambelet argues that unstable arms races can in fact be limited by economic capacity.21 The Soviet Union in the 1980s found that it simply did not have the economic ability to match American investment in space as a result of Reagan’s Space Defense Initiative (SDI) and so pursued more cooperative, diplomatic strategies.22

That economic limits can place a ceiling on arms races is important given the commercial imperative advanced in this book. The research cited in Chapter 2 focuses mostly on economic effects on conflict in general, but some studies have looked at the relationship between trade and arms races specifically. Rafael Reuveny and John Maxwell find that trade may not always dampen an arms race.23 Some states may choose to direct the profits of commercial trade towards investment in arms races; in that case, the competition is not resolved. Reuveny and Maxwell argue that the only means through which free trade can reduce or end arms races is if a state can be persuaded that it will receive greater utility from investing their profits in a non-military sector than using them to purchase more arms. On the other hand, Syed Mansoob Murshed and Dawood Mamoon find a conflictreducing effect of trade in their analysis of relations between India and Pakistan.24 Though their study focuses only on one pair of states, their findings are instructive. Bilateral trade has an effect of reducing military expenditures, but the more significant influence was each country’s degree of openness to the global economy.

In sum, states may engage in arms races for a number of reasons including defense, deterrence, prestige, and domestic factors. While arms racing can contribute some to the chances of open conflict, war is far from inevitable. The more likely result is for arms races to be ended by some outside factor that either solves the underlying political conflict or turns a country’s attention away from the dispute. Arms races can be stabilizing to a degree and in turn can be stabilized by technological and economic limits. Thus, arms races do not create inevitable spirals of action and reaction leading to war in general, and, specifically, in terms of space.

The Cold War space race

Many of the dynamics discussed previously are apparent in the Cold War space race, including a competition for prestige, an economic limit to the potential for competition, and pressure from internal factions to increase arms. Before Sputnik was even launched in 1957, there was an ongoing arms race between the two countries. While it was not yet totally focused on missiles and missile technology, the massive buildup in terms of nuclear weapons was already well underway. Though the number of Soviet nuclear weapons never approached the quantity of the United States, the US’s fleet of B-52 bombers, a proportion of which were always in the air, gave the US a strategic advantage in terms of their use.25 Given their startling disadvantages, the Soviets emphasized missile technology as a means of delivering a nuclear punch. The early development of rocketry and its relationship to missile technology is discussed elsewhere; for our purposes, the importance of the start of the Cold War space race is that it inaugurated a new, non-militarized arena in which the US and Soviet Union compete.26

Because of the close linkage of missiles with rockets, the space race is often considered either in tandem or implicitly with the missile race of the late 1950s. In the public’s mind, particularly at the time, the two issues were often conflated. The launch of Sputnik initiated something of a panic in many Americans, if not in their top political leadership. Despite concerns among citizens about the apparent gap in Soviet and American technology following Sputnik’s launch, they were reinforced by the lack of a response from the Eisenhower administration. Walter A. McDougall makes two points about Eisenhower’s rather muted reaction. First, Eisenhower and his administration possibly preferred that the Soviets launch a satellite first in order to establish the flyover right of satellites (though this has been doubted by other space historians). Second, most in the president’s leadership team knew that no missile gap existed; while this finding and the evidence for it could not be released to the public, Eisenhower believed the public outcry over Sputnik was unfounded.27

This supposed missile gap stoked fears among the American public and caused political leaders, particularly in Congress, to push for new initiatives. Eisenhower, fearing an enlargement of the budget, remained steadfast in his opposition not only to a missile gap but to significant increases in funding which he believed were unnecessary. The Soviet rocket that launched Sputnik was a technological revolution, but it was quite unsuited as an intercontinental ballistic missile (ICBM).28 The rocket, which was liquid fueled, required hours of preparation time before launch; in the event of a nuclear war, it would be near impossible to fuel the missile and launch it before any attack took place. Further, the administration had evidence via U-2 overflights that construction of launch pads, a prerequisite to an ICBM capability, had not fully started.29 However, critics of Eisenhower in Congress used the opportunity to push not just for more funds but also for additional missiles to close the supposed gap. The public pressure grew. “Although Eisenhower opposed the concept of racing in space,” Moltz writes, “officials in the administration could no longer deny that something needed to be done to address this crisis of credibility in regard to US space capability, particularly in the highly visible civilian area.”30 It was out of this debate in 1957–1958 that Eisenhower made the decision to split responsibility for space between a civilian agency, the new National Aeronautics and Space Administration (NASA), and the military.

Between 1958 and 1960, Eisenhower walked a middle ground, at once both trying to restrain the competitive urge brewing in the United States and appearing responsive to public and congressional concerns. Budgets for the Department of Defense rose, NASA was created, and the National Defense Education Act was passed providing funds for education in science, mathematics, and languages. Despite this, there was still a great deal of frustration with Eisenhower’s response. During the 1960 presidential campaign, candidate John F. Kennedy used fears of a missile gap to criticize the administration and Vice President Richard Nixon, Kennedy’s opponent. Nixon, knowing the missile gap did not, in fact, exist, attempted to downplay the threat and emphasize an American lead in technology. However, “With Kennedy’s victory, a cautious military-led program that had rejected racing was replaced by a daring, expensive, and highly competitive program with the unabashed goal of establishing the United States as the leading space power.”31 Further setbacks in regard to the Communist threat early in Kennedy’s administration (the failure of the Bay of Pigs invasion and Yuri Gagarin’s launch among them) pushed Kennedy to consider potential American responses that demonstrated resolve and ability to the rest of the world. The need to reestablish American prestige and respect contributed to Kennedy’s call in May 1961 for an American mission to the moon by the end of the decade.

The search for prestige and respect played a role from the beginning in establishing the purposes of the space race. In a National Security Council policy document released in August of 1958 and approved by Eisenhower, “the NSC judged that continued Soviet superiority in space might undermine US prestige and security.”32 By January of 1960, the administration fully recognized the psychological impacts of space achievements and their ability to influence American prestige. “Hence, US policy was to demonstrate an overall superiority in outer space, stress projects which offer the promise of obtaining a demonstrably effective advantage, and proceed with manned spaceflight ‘at the earliest practicable time.’”33

The space race continued into the 1960s on two different tracks, one that was civilian focused, premised on prestige and a second in terms of developing military capabilities in space. While the full implications of space were not yet clear by 1960, the United States got off to an early lead in developing passive systems for reconnaissance and communications. The Soviet Union attempted to protest such missions for fear of spying, but they soon developed similar capabilities and realized advantages in these areas as well. The growth of ICBMs and improvements in their technologies also caused both states to consider anti-ballistic missile systems (ABM) with launch sites on the ground and potentially in space. However, James Andrew Lewis argues that the development of these systems was incremental and fragmented, a pattern “indicative of early attitudes about the military utility of space.”34 To Lewis, this fragmentation demonstrates that military planners of the time saw space systems as tools and accessories and not a military capability. The scattershot approach to the military purposes of space soon began to interact with the civilian space race in ways that highlight the nature of the space environment and limit potentially destructive activity.

In the early 1960s, as both states began to engage in human spaceflight and conduct high altitude nuclear tests, participants began to notice the effects that radiation and electromagnetic pulses generated by the explosions were having on the space environment. Though there seemed to be a growing recognition that further weapons testing was harmful to both sides, the scientific and military momentum on each side propelled further development. In 1962, Kennedy pressed his advisors for limits on US nuclear testing. Failures in several American nuclear tests as well as their effect on satellites “caused the president to change his mind about nuclear testing in space” in the summer of 1962.35 As a result, Kennedy set new limits on nuclear testing in space, something which went against the desires of air force officials at the time.36 These concerns, coupled with the impact of the Cuban missile crisis, led both sides to reconsider hostile actions in space because of the possible danger to the space environment. Out of this, a period of “cooperative restraint” emerged that found both the Soviet Union and the United States engaging in renewed diplomatic efforts as well as rolling back potentially dangerous military applications of space including the Air Force’s sought after Manned Orbiting Laboratory (MOL). Cooperative restraint set the stage for increased cooperative relations between the two space programs, all culminating with the Apollo-Soyuz Test Project in 1975.

While this is a rough sketch of the events of the early space race, it is instructive in considering what pulled these two countries back from the brink. Clearly, both were interested in space for military purposes and plans were being made to exploit space-based advantages. However, as both sides realized their actions in terms of nuclear tests and debris were harming the space environment in ways that limited their freedom of operations, moves to weaponize space were curbed.37 Moltz calls this idea “environmental interdependence”—states interested in space are interdependent on the space environment (in this case for the purposes of national security) and must act accordingly. To this, I would add that the civilian side of the space race, the race to launch humans into orbit and eventually to the moon, reinforced the concept of environmental interdependence. Part of the reasoning behind Kennedy’s decision to limit high altitude nuclear tests was over concern about their impact on upcoming American spaceflights. In order to continue racing on the civilian track, it was necessary to curb competition on the military track to limit the dangers that astronauts and cosmonauts faced in near-earth orbit.

This notion is not at all inconsistent with the commercial space peace theory proposed in this book. During the early space race period, the economic impacts of space were not yet clear or exploitable, thus economic impacts could not serve to restrain conflict. What did put a damper on the danger of conflict was the recognition that weaponization of space would detrimentally affect other activities that states wished to undertake. By the early 1960s, EMPs set off by a nuclear test disabled several Soviet and American satellites and there was growing evidence that debris posed a dangerous problem in near-earth orbit. The logic of conflict avoidance was the same: the interdependence of states with the space environment constrained conflict. In the 1960s, it was on the basis of national security; today, in addition to national security concerns are economic concerns that involve far more states, commercial entities, and individual people than ever before.

Under the umbrella of cooperative restraint and the stability it encouraged, major states engaged in renewed diplomatic exchanges and economic development of space began. The United States created the Communications Satellite Corporation (COMSAT) in 1963 which led to the founding of the International Telecommunications Satellite Consortium (INTELSAT) to foster the development of communications satellites. By the early 1980s, the Reagan administration introduced new policy directives designed to support a private space industry in the United States.38 However, by that point, tension in space between the two powers was once again increasing. Lorenzini and Fox, discussed at the beginning of this chapter, leveled their warning of coming conflict in 1981. Richard L. Garwin, instrumental in the creation of the hydrogen bomb, also expressed concern of a new arms race in space in 1981, using the opportunity to push for new bilateral arms control agreements.39 Both of these warnings occurred before Ronald Reagan’s announcement of SDI in 1983 which represented a new push for the potential weaponization of space. SDI, with its proposed significant increases in research and development for a space-based ballistic missile shield, threatened the stability of space competition with the possible introduction of ABM launchers in outer space, contrary to the Anti-Ballistic Missile Treaty of 1972. Though the budget for the Department of Defense and space research and development increased, the plan faced stiff resistance among the public, Democratic majorities in Congress, and some in the DOD who recognized the dangers inherent with SDI. Congress in particular was concerned not just with the large price tag but with the potential for violating the ABM Treaty and the technical feasibility of the program.40 Added to that, new ASAT development and testing occurring outside of the SDI at this time revived concern about the possibility of troublesome debris in earth orbit.

The Soviets responded to these developments by calling for greater arms control negotiations, particularly given major setbacks in their civilian spaceflight program and the inadequacies of their military space programs.41 Soviet leadership changes also greatly affected Soviet responses. Mikhail Gorbachev, having come to power in the mid-1980s, not only “moved to break the stranglehold of the military on the space program” so that the US would be assured of their non-aggressive motives in space but also sought to use space technology commercially on the global market.42 Soviet ambitions economically would be greatly harmed by conflict stimulated on the part of SDI. Thus, by the mid-1980s, a less hostile position on the part of Reagan following his reelection and Soviet efforts at transparency and openness in terms of space cooled the fever of increased competition.

Like the 1960s, recognitions of interdependence also served to restrain possible conflict in space in the 1980s. Interestingly, in addition to concerns about the possibility for debris in earth orbit, the Soviets now added an economic motive to curbing competition. This demonstrates not just a “relearning” process as Moltz argues but the incorporation of new bases for decisions as the economic importance of space began to increase. Ironically, the economic concern came on the part of the Soviet Union, a communist state with a heretofore state-controlled economy. This is important not only because it demonstrates that space-based economic concerns can influence and even constrain state actions in space but also that states organized along similar lines to the Soviet Union can be affected by economic motivations. Though China’s economy today is not as controlled as it once was, the state is still heavily involved, particularly in space. That there is historical evidence of economic concerns influencing the actions the Soviet Union in space speaks to the fact that China could be just as easily impacted today especially since economic dependence on space and economic globalization has increased dramatically since the 1980s.

The Cold War, as we know today, did not lead to the inevitable conflict predicted by analysts throughout the period. The more general arms race between the Soviet Union and the US was, to an extent, stabilizing. The race for prestige in space presented a contest that could be pursued through less militarized means, thereby providing an outlet for competitive tendencies.43 Internally, bureaucratic agencies pushed for new investments in space technology, but cost concerns often limited them as was the case in both the US and Soviet Union in the 1980s. And finally, as the economic dimension of space came to be understood, an additional constraint was introduced into the calculations of the two superpowers.

A new space race? Lessons in a period increased tensions

Today, we find ourselves in a situation where tensions in space are once again increasing. India’s ASAT test in March of 2019, China’s increased military activities with regards to space, and calls for the United States to create a new Space Force are just some of the indicators of growing risk. The withdrawal of the United States from the ABM Treaty by George W. Bush in 2001 opened the doors to development of ABM systems that could be partially (or even fully) located in outer space. While the US has encountered significant difficulties in developing even ground-based systems, the fact that the US moved to develop them was seen as threatening particularly by an emerging China. As reported by Moltz, in 2005, China’s ambassador to the UN Conference on Disarmament “argued that spacebased defenses would ‘undermine international security,’ damage the current arms control environment, and trigger a ‘new arms race.’”44 Despite their public statements of concern, China’s ASAT test in 2007 also upped the ante. A pull back from more aggressive actions in space with the Barack Obama administration was ended as the inauguration of Donald Trump as president has brought with it an increased focus on strong defense capabilities and protection of US capabilities in space, consistent with the idea of space nationalism.

This situation has led some to believe there is a new space race. When announcing new American plans to return to the moon by 2024, Vice President Mike Pence stated, “Make no mistake about it—we’re in a space race today, just as we were in the 1960s, and the stakes are even higher.”45 Citing the successful Chinese landing of its Chang’e-4 lunar probe on the far side of the moon in January 2019, the vice president argued that it “revealed [China’s] ambition to seize the lunar strategic high ground and become the world’s pre-eminent spacefaring nation.”46 While Pence argues there is an ongoing race, neither Russia nor China seem to be engaging in it, at least from a civilian spaceflight perspective. China has continued on a slow, steady pace in their program with no apparent moves to speed up the process. Russia’s space program is experiencing severe economic restraints that has led them to actively consider working with the Chinese on their upcoming space station project.47 Pence’s invocation of a global competition based on an obvious military rationale (seizing the lunar high ground) is reminiscent of the original space race motivations of reclaiming prestige based on a seemingly strategic goal. In terms of civilian spaceflight, at least, the hoped-for competition that might spur greater support for crewed missions to the moon does not appear to be emerging.

There is perhaps more evidence to support an increasing military space race focused not just on passive space systems but weapons as well. Vice President Pence, who has been at the forefront of space issues for the Trump administration, wrote in an op-ed for The Washington Post in February 2019 that “China and Russia are aggressively developing and deploying capabilities—including anti-satellite weapons, airborne lasers, menacing ‘on-orbit’ capabilities and evasive hypersonic missiles—that have transformed space into a warfighting domain.”48 Russia, for its part, conducted a test of a new anti-satellite weapon in late 2018 and a new space-based interceptor designed for use by 2022 and launched from a Russian MiG-31was photographed as well.49 More generally, a declassified US government report, “Competing in Space,” from the National Air and Space Intelligence Center claims that “[a] number of foreign countries are believed to be testing on-orbit, space-based anti-satellite technologies and concepts” and that because of reduced costs, more actors will seek to integrate military capabilities with space-based systems in the coming years.50 Thus, while there does not appear to be any pressure to quicken the pace of civilian spaceflight, there is increasing interest in space for both militarized and weaponized purposes.

The tension in space suggests that space leaders have once again “unlearned” the lessons of the 1960s and 1980s. Despite some similarities to those periods in terms of the space environment, the differences are quite significant and serve to heighten the importance of avoiding conflict. For one, debris concerns, present since the 1960s, are exponentially greater today. The US Joint Space Operations Center currently tracks more than 23,000 larger than 4 inches but there is an estimated 500,000 pieces of debris between 0.4 and 4 inches that are not actively tracked.51 The problem is only getting worse. US Air Force General John Hyten, testifying before Congress shortly after the Indian ASAT test, reiterated his concerns about debris that he believes will endanger future missions and the use of space.52 Combined with the increasing number of actors, both government and private, involved in space, and the significant economic and military reliance on space, the stakes have never been higher.

Given this, past lessons can help contribute to new learning about these risks in order to mitigate them. In the 1960s, the US and Soviet governments had to learn for the first time about these dangers by experiencing early consequences. In the 1980s, changes in leadership and attitude toward the Soviets pushed a more aggressive stance which was restrained by an institutionalized memory regarding the necessity of debris avoidance as well as an institutional dedication to the norms and agreements. In the Soviet Union, new recognition of the economic potential of space technology taught a new generation of leaders that to foster their own economic goals, they had to restrict behavior in the military realm. Today, leaders who are themselves reflective of more nationalistic feelings in their own countries are once again pushing the boundaries. There is evidence, however, that institutional memory is still present. In the US, military leaders continue to express concern about the problems of space junk which is often reflected by Chinese leaders as well. Commercial actors with profits at stake also clearly understand the risk posed by debris. In the past, it took significant incidents in space to reinforce the lessons: in the 1960s, EMPs had to disrupt Soviet and American satellites. In the 1980s, the Soviets experienced significant setbacks in their civilian and military space programs including the destruction of a nuclear-powered satellite over the Atlantic Ocean.53 One argument might be, then, that it will take some sort of dramatic incident for leaders in space states to pay attention to these concerns as this is often the case for public policy problems in general. In this instance, there is little evidence to support it. The Chinese ASAT test in 2007, the collision of an inactive Russian communication satellite and an active US-based communications satellite in 2009, and the more recent 2019 Indian ASAT test, all dramatically increased the amount of debris in near-earth orbit and yet the hostile rhetoric in space has continued.

Another reason for conflict avoidance particularly in the 1960s was that it posed a risk to the civilian space race which was a political priority for both the USSR and US. With the renewed push in civilian space exploration by both the United States and China today, this could be one way to siphon off more aggressive instincts in space. Other countries and private corporations are also planning for human spaceflight: India has plans to send its first crewed spacecraft into orbit by 2022 while Virgin Galactic could be sending paid passengers on suborbital trips in the very near future. As more people seek to explore space for themselves, the imperative to protect life in an environment that is already incredible hostile to it can once again reassert itself to restrain conflictual behavior. Though this is possible, there are still significant hurdles for both private companies and government organizations to overcome in their human spaceflight plans including funding and successful demonstrations of their technology and capabilities.

Finally, diplomatic efforts engaged in by the two Cold War superpowers in the mid- to late-1960s helped to cement the cool off in space and institutionalize norms of behavior. Diplomatic engagement could also provide a solution today, but given American actions over the past 20 years, formal diplomatic efforts are likely to face significant hurdles if not outright failure. The Bush administration’s withdrawal from the ABM Treaty in 2001 removed one of the significant restraints on the development of weapons in space, opening the doors not just to research and development on the part of the US but for Russia as well. While the Obama administration was more open to diplomatic efforts, the political conditions at home were not suitable; in order for the United States to formally join a treaty, it must be approved by the US Senate. With an almost even split between Democrats and Republicans, the administration would likely have found a difficult bargaining environment as it did with the Trans-Pacific Partnership and Paris Climate Accords, agreements that were deeply unpopular with the Congress in general. The Trump administration has been even more openly hostile to international agreements, withdrawing the US from both the TPP and Paris Agreement upon taking office. More recently, Trump also withdrew the US from the Arms Trade Treaty, initially signed by Barack Obama in 2013 but never ratified by the Senate. In doing so, he stated, “Under my Administration, we will never surrender American sovereignty to anyone.”54 Although the treaty was unlikely to be approved by the Senate (reinforcing the idea that diplomatic negotiations likely had little chance under Obama anyway), the statement reflects the more nationalistic tone of the Trump administration.

Learning and relearning the dangers of conflict, redirection of attention to civilian spaceflight, and diplomacy have all helped in the past to reduce the chances of conflict in periods where some saw war as just about inevitable. In fact, these solutions might be more applicable today than previously particularly as the threat of debris grows and more actors require greater international coordination. Kai-Uwe Schrogl, head of the Strategy Development Department for the European Space Agency, wrote in a reflection on the OST that maintaining the “situational structure [of space] is probably more influential than any attempt to prevent an arms race in outer space by negotiating a treaty.”55 But just because they are more applicable does not mean they are more likely. In each instance, there is clear evidence that in the recent past, the danger of debris, a political commitment to human spaceflight, and diplomatic efforts have all failed at reducing the threat of conflict in space. If the tensions cannot be stopped, the chances of a renewed arms race in space, particularly in terms of military space between the major powers, are even more real.56

If this is the case, we can consider for a moment the policy prescription that analysts like Lorenzini and Fox and Dolman have proposed. If weaponization of space is inevitable, then the US should make reasonable preparations to be the one to do so and exert control over the space environment. Dolman writes,

To be sure, China’s increasing space emphasis and its cultural antipathy to military transparency suggest a serious attempt at seizing control of space is in the works. A lingering fear is the sudden introduction of an unknown capability (call it Technology X) that would allow a hostile state to place multiple weapons into orbit quickly and cheaply. The advantages gained from controlling the high ground of space would accrue to it as surely as to any other state, while the concomitant loss of military power from the denial of space to America’s already space-dependent military forces could usher in a significant reordering of the international system. The longer the United States dithers on its military responsibilities, the more likely a potential opponent could seize low-Earth orbit before it is able to respond.57

Though Dolman acknowledges that such moves are likely to result in “severe condemnation and increased competition in peripheral areas,” he does not believe it heralds an arms race.58 On the contrary, it can actually prevent one by allowing the US to focus on space weapons systems that would replace ground-based systems and troops stationed around the world. By reducing ground armaments and relying on space-based instruments of power, other states would seemingly feel less threatened by US moves.

Matthew Burris responds directly to Dolman’s argument and more generally to the arguments pursued by space nationalists.59 He argues that conflict with China is not inevitable especially because of the global environment we now find ourselves in that employs a variety of cooperative organizations like the UN, recognizes international norms and laws, and finds itself deeply intertwined economically. While a Thucydides’ trap might have been hard to avoid in the past, the context in which a power is rising has significantly changed so that it may be avoidable today. Further, Burris argues that other states will not let US development of means of control in space go unanswered: “Are we to assume,” he asks, “they are patiently awaiting the completion of an ‘unstoppable’ constellation of space weapons?”60 Burris concludes that utilizing Dolman’s own “power politics thesis,” he is precipitating the very arms race he seeks to avoid by encouraging US domination in space.61 He points out that US reliance on space weapons over ground-based weapons would be its Achilles’ heel. “A space hegemony strategy, pursued at the expense of combined arms, would represent a potential single point of failure for the national security of the United States.”62

The logic of space hegemony or space nationalism in order to avoid conflict or even an arms race is not, on the whole, persuasive. This is not to say that a new space race is avoidable or unavoidable, simply that the solution of US domination of space (or really, domination of space by any state) is not feasible nor is it strategically sound. We are left in a situation, then, of increasing space tensions where responses on both ends of the spectrum, complete internationalization of space control and complete state domination, are unlikely to occur. Past solutions also seem unlikely at this point, but there are additional actions that might help introduce a new détente. Downs, Rocke, and Siverson, in their analysis of arms races, discuss four types of unilateral strategies that can reduce the intensity of arms races.63 First, states can focus on defensive rather than offensive weapons technology. Though they find little historical evidence of such actions actually reducing the heat in an arms race, in terms of space, this strategy might be helpful. John Klein has noted that far more attention has been paid to offensive space weapons as opposed to defensive despite the argument that defensive weapons may be stronger and more important.64 ASATs are, by their very nature, offensive in nature. The recent focus on them by states including the US, Russia, China, and India can only heighten tension.

A second strategy is defensive alliances, however, this, like defensive weapons, finds little support in Downs, Rocke, and Siverson’s analysis. Countries could try to extend their current alliances, for example, the North Atlantic Treaty Organization (NATO), into the space realm.65 For instance, if a member of NATO had a satellite destroyed by a non-member, it is unclear whether article 5, the collective security clause, could be invoked precisely because the rules of war in space are unclear. For example, an ASAT that destroys a NATO-member’s satellite might be considered an act of war because the OST prohibits “non-peaceful” activities in space. The US has interpreted “non-peaceful” to mean “non-aggressive”; an attack by a kinetic ASAT would certainly be considered non-peaceful and quite aggressive. However, if a state’s satellite were disabled by a laser or some other close means, would that be considered an attack? The attacking country could claim that they disabled the satellite out of a defensive purpose and argue their action was therefore “peaceful” since defensive operations are allowed under international law. The lack of clarity on an issue such as this would likely prevent NATO, or any defensive alliance, from agreeing on whether to invoke the premise of collective security unless space was specifically protected under the alliance agreement. On the other hand, defensive alliances could create a cascade of war as they did with World War I, making their extensive use unlikely.

Downs, Rocke, and Siverson’s third unilateral strategy is the creation of buffer states but that is not applicable to a region such as space. However, the fourth unilateral strategy is that of “acquisition and surrender of intelligence information.”66 States may be motivated to reveal information and preferences so as to convince others of their intentions and purposes of action. However, such information and cooperation can come about in other ways as well. During the Cold War space race, collaborative efforts between the Soviet Union and the US helped not only to smooth tension between the two but cooperation also gave them a chance to exchange information. Granted, the information exchanged was often not very technical or militarized in nature; it usually consisted of scientific exchanges or, at times, cooperative spaceflight efforts. Regardless, lower level technical and scientific cooperation and exchange can be important. Steven J. Majeski argues that in arms races in general, cooperation can slow the ramping up effects of technological innovation.67 In terms of space specifically, a number of analysts have argued that cooperation with China today can reduce hostile competition and mitigate dangerous outcomes.68 Cooperation, even beginning at a low level, can be an important step to building trust and paving the way for further work in the future.

The logic of cooperation is powerful and beneficial. Cooperation becomes even more important as the number of actors grows, the common resource (in this case, space) dwindles, and the environmental and economic interdependence of space grows. While cooperation between the US and China, the US and Russia, or even Russia and China can contribute to reduced tension militarily, in order to truly secure the space environment for all interested parties, all space users must be prepared to cooperate. As the number of users grows, the potential for free riders, those who take advantage of the actions of others, grows as well. Tension in space is no longer predicated along bilateral lines, it is now globalized, requiring cooperation from all to achieve a common good. In this sense, the solutions of the past may simply not be applicable to today’s space operating environment.

What is applicable and what is of concern to most, if not all, space users are the economics of space. Whether a state or private actor, access to space and space systems costs money; the easier it is to access space and operate there, the lower the costs will be. Even for state governments, the costs of a system are a limitation. Congress was concerned by the cost of Reagan’s SDI in the 1980s. China placed an emphasis on the commercial aspects of their launch technology before they started their current human spaceflight program. The Soviet Union, now Russia, has been perpetually beset by economic concerns in their spaceflight programs and industry. Thus, one thing that all space actors have in common, regardless of their intentions or whether they are public, private, commercial, or scientific, is a concern with cost. Those actions which increase the costs of space hurt everyone and must be restrained.

The costs of space are on top of the costs to global economy if space-systems and/or access to space were interrupted. Given the one-two economic punch a state would receive if conflict were to occur in space, they have all the more reason to take actions that do not contribute to such a scenario to create a more secure space environment. Short of international negotiations to create a space code of conduct or more formal international agreements, the least states can and should do is make prudent policy choices that do not inflame tensions or create scenarios where conflict is likely to occur.

This chapter has argued that even during the original space race, the US and Soviet Union recognized the impact that each other’s actions could have on freedom of movement in space. That interdependence has evolved over time to include more and more extensive dimensions of interdependence, more states, more actors, and more problems. While the means of dissolving space-based tension that were used in the space race remain real and palpable today, the current space environment has created a condition where economic concerns can play a far larger role in constraining conflict. While much of this chapter has focused on state actors like the US, Russia, China, and India, commercial and private actors are playing an increasingly important role in space. Not only are they developing means of launching space systems, but some even plan on extensive solar system exploration. Because of this, they are likely to be concerned about the economic costs of space, but they are also in a position to influence government actions on this front as well. The next chapter discusses these “new space” actors, their motivations, and their capability, and willingness, for action.

### No Miscalc 1NC

#### Miscalculation is highly unlikely

James Pavur 19, Professor of Computer Science Department of Computer Science at Oxford University and Ivan Martinovic, DPhil Researcher Cybersecurity Centre for Doctoral Training at Oxford University, “The Cyber-ASAT: On the Impact of Cyber Weapons in Outer Space”, 2019 11th International Conference on Cyber Conflict: Silent Battle T. Minárik, S. Alatalu, S. Biondi, M. Signoretti, I. Tolga, G. Visky (Eds.), <https://ccdcoe.org/uploads/2019/06/Art_12_The-Cyber-ASAT.pdf>

A. Limited Accessibility Space is difficult. Over 60 years have passed since the first Sputnik launch and only nine countries (ten including the EU) have orbital launch capabilities. Moreover, a launch programme alone does not guarantee the resources and precision required to operate a meaningful ASAT capability. Given this, one possible reason why space wars have not broken out is simply because only the US has ever had the ability to fight one [21, p. 402], [22, pp. 419–420]. Although launch technology may become cheaper and easier, it is unclear to what extent these advances will be distributed among presently non-spacefaring nations. Limited access to orbit necessarily reduces the scenarios which could plausibly escalate to ASAT usage. Only major conflicts between the handful of states with ‘space club’ membership could be considered possible flashpoints. Even then, the fragility of an attacker’s own space assets creates de-escalatory pressures due to the deterrent effect of retaliation. Since the earliest days of the space race, dominant powers have recognized this dynamic and demonstrated an inclination towards de-escalatory space strategies [23]. B. Attributable Norms There also exists a long-standing normative framework favouring the peaceful use of space. The effectiveness of this regime, centred around the Outer Space Treaty (OST), is highly contentious and many have pointed out its serious legal and political shortcomings [24]–[26]. Nevertheless, this status quo framework has somehow supported over six decades of relative peace in orbit. Over these six decades, norms have become deeply ingrained into the way states describe and perceive space weaponization. This de facto codification was dramatically demonstrated in 2005 when the US found itself on the short end of a 160-1 UN vote after opposing a non-binding resolution on space weaponization. Although states have occasionally pushed the boundaries of these norms, this has typically occurred through incremental legal re-interpretation rather than outright opposition [27]. Even the most notable incidents, such as the 2007-2008 US and Chinese ASAT demonstrations, were couched in rhetoric from both the norm violators and defenders, depicting space as a peaceful global commons [27, p. 56]. Altogether, this suggests that states perceive real costs to breaking this normative tradition and may even moderate their behaviours accordingly. One further factor supporting this norms regime is the high degree of attributability surrounding ASAT weapons. For kinetic ASAT technology, plausible deniability and stealth are essentially impossible. The literally explosive act of launching a rocket cannot evade detection and, if used offensively, retaliation. This imposes high diplomatic costs on ASAT usage and testing, particularly during peacetime. C. Environmental Interdependence A third stabilizing force relates to the orbital debris consequences of ASATs. China’s 2007 ASAT demonstration was the largest debris-generating event in history, as the targeted satellite dissipated into thousands of dangerous debris particles [28, p. 4]. Since debris particles are indiscriminate and unpredictable, they often threaten the attacker’s own space assets [22, p. 420]. This is compounded by Kessler syndrome, a phenomenon whereby orbital debris ‘breeds’ as large pieces of debris collide and disintegrate. As space debris remains in orbit for hundreds of years, the cascade effect of an ASAT attack can constrain the attacker’s long-term use of space [29, pp. 295– 296]. Any state with kinetic ASAT capabilities will likely also operate satellites of its own, and they are necessarily exposed to this collateral damage threat. Space debris thus acts as a strong strategic deterrent to ASAT usage.

### No Space War 1NC

#### No space war--- interdependence and deterrence check.

Bragg et al, July 2018 - \*Dr. Allison Astorino-Courtois, NSI’s Chief Analytics Officer (CAO) and Executive Vice President, PhD in IR @ NYU \*\*Dr. Robert Elder, PhD @ Emory, BA @ Clemson, Assistant prof of History @ Baylor \*\*\*Dr. Belinda Bragg, principle research scientist at NSI, Inc. Lecturer in polisci @ Texas A&M.;“Contested Space Operations, Space Defense, Deterrence, and Warfighting: Summary Findings and Integration Report,” NSI, https://nsiteam.com/social/wp-content/uploads/2018/11/Space-SMA-Integration-Report-Space-FINAL.pdf

Everyone needs space

While the US may be relatively more dependent on space for national security than are other states, it is far from alone in relying on space. Nuclear armed states are dependent on space for important command and control functions, and major powers are increasingly using space for battlefield situational awareness and communications. China and Russia were identified as having significant (and fairly equal) levels of strategic risk in space (ViTTa Q16), although their regional security priorities and (to date) less spacedependent economies place them at an advantage to the US. They may, therefore, see the strategic risk of conflict is space as lower than does the US. Still, space capabilities remain a source of economic expansion and national pride for both, and their calculations of the cost of conflict involving space may include consideration of these factors. Even now, there is a general consensus that the US and other actors have more to gain from space than they have from the loss of space-based capabilities (ViTTa Q3). This suggests that, although the US is more vulnerable in the space domain than are other states, the likelihood that aggressive action against an adversary’s space assets would be reciprocated may provide a degree of security. It also creates another incentive for actors to use diplomacy and international law to reduce risk and increase transparency in the space domain.

## Collisions

### Turn

#### Commercial mining solves extinction from scarcity, o-pop, climate change, terror, shortages, inequality, war, and disease- timeframe is mere decades- only mining solves BUT now is key

Pelton, 17 -- a member of the Executive Board of the International Association for the Advancement of Space Safety

[Dr. Joseph N., former Chairman of the Board of Trustees and Vice President and Dean of the International Space University as well as the Director Emeritus of the Space and Advanced Communications Research Institute (SACRI) at George Washington University, The New Gold Rush: The Riches of Space Beckon!, Springer, 2017, accessed 1-9-22]

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

### CP Solves

#### The counterplan solves all of their war scenarios—those just say the legality of property is ambiguous now, which causes conflict, but the CP resolves that ambiguity just as well as the aff by clarifying that property is allowed rather than banned.

### AT Asteroids

#### CP solves the deflection dilemma- it bans moving asteroids near Earth

#### But if it doesn’t, asteroid mining tech solves asteroid collisions - extinction

Taylor 19 Chris Taylor is a veteran journalist. Previously senior news writer for Time.com a year later. In 2000, he was named San Francisco bureau chief for Time magazine. He has served as senior editor for Business 2.0, West Coast editor for Fortune Small Business and West Coast web editor for Fast Company. Chris is a graduate of Merton College, Oxford and the Columbia University Graduate School of Journalism. "How asteroid mining will save the Earth — and mint trillionaires." Mashable, 2019, mashable.com/feature/asteroid-mining-space-economy. [Quality Control]

For those who worry about asteroids that could wipe out civilization — though luckily, this isn't likely to happen any time soon — here is a way for humanity to get proficient in moving them out of the way, fast. Indeed, the National Space Society has offered a proposal to capture the asteroid Aphosis (which is set to miss Earth in the year 2029, but not by a very comfortable margin), keep it in orbit, and turn it into 150 small solar-power satellites, as a proof of concept.

### AT Debris

#### Their ev lists alt causes- satellites,

#### Not worse than meteoroids because of slow streams, and small asteroids solve

Fladeland, 19 -- Fellow at the Outer Space Institute

[Logan, Aaron C. Boley, Michael Byers, Meteoroid Stream Formation Due to the Extraction of Space Resources from Asteroids, Conference paper for the 1st International Orbital Debris Conference, December 2019, <https://arxiv.org/abs/1911.12840>, accessed 6-25-21]

5 DISCUSSION

Should large NEAs be targeted for resource extraction, then they could, in principle, produce streams with number fluxes that exceed the sporadic meteoroids, although it would require prodigious mass release from the asteroid. We have only considered a flat mass distribution for the amount of material that is ejected at each �, and have assumed that each bin has 1% of the asteroid’s original mass in the stream. For the six particle sizes that we consider, the hypothetical Ryugu stream would thus have a mass of about 2.7 × 10OQ kg. Over the envisaged 10 yr of mining, this would require 7.4 × 10s kg per day on average or the consumption of roughly 6200 m3 per day for � = 1200 kg/m3 (about a soccer pitch that is one metre deep). The total stream mass (6%) would be equivalent to stripping the entire surface of the asteroid to about 18 m deep.

The hypothetical stream from 2005 YU55 is about an order of magnitude less in mass, as well as the corresponding average daily volume consumption (slightly larger than a 25 m x 25 m x 1 m volume). This hypothetical stream’s number flux also exceeds the sporadics for the smallest �, despite the lower mass compared with Ryugu. Such mining would still require multiple machines and significant infrastructure, the feasibility of which is not known. Regardless, the potential for large-scale mining is being explored (e.g., [24,25]). Apart from technical feasibility, there would need to be sufficient demand for ISRU to require such prodigious resource extraction, which will depend strongly on future space traffic, which is also unknown.

In some ways, the results are reassuring, in that the sporadic meteoroid population could be far more significant than any streams produced from asteroid mining, if proper limits are put in place. However, we do not want to dismiss the possibility of secondary effects that could result in large mass expulsions caused by manipulating the asteroid’s surface.

These hypothetical streams also have significant differences when compared with some of the major (and real) meteoroid streams [26]. For example, relative speeds tend to only have �t between about 4 and 14 km/s, lower than the major streams, although this is without considering focusing due to Earth.

We have also ignored the possibility of mining small asteroids (in the tens of metre diameter range), which at face value might be more tractable, at least initially. Even if the entire asteroid is effectively reduced to meteoroids, the mass of the stream would be much smaller than that considered here. On the other hand, small asteroids will likely be selected from the population that comes within a few lunar distances of Earth, meaning the resulting streams could be significant despite their mass.

Finally, when releasing particles from the parent body, we only considered an expulsion speed of 1 m/s (for the mode of a Rayleigh distribution). A larger speed would could affect the stream size and decrease the shearing timescale.

#### Robots solve

Gao, 21 -- Reporter at Reuters

[Liangping, and Ryan Woo, "China launches robot prototype capable of catching space debris with net," Reuters, 4-27-21, https://www.reuters.com/lifestyle/science/china-launches-robot-prototype-capable-catching-space-debris-with-net-2021-04-27/, accessed 6-25-21]

BEIJING, April 27 (Reuters) - A Chinese space mining start-up launched into low Earth orbit on Tuesday a robot prototype that can scoop up debris left behind by other spacecraft with a big net. The NEO-01, which will also peer into deep space to observe small celestial bodies, was launched on the government's Long March 6 rocket along with a handful of satellites, state-run Xinhua news agency reported. The 30kg robot developed by Shenzhen-based Origin Space will pave the way for future technologies capable of mining on asteroids, according to the company. Since the establishment of the world's first asteroid mining company Planetary Resources in 2009, more than a dozen firms across the world have entered the fledging sector, including 3D Systems (DDD.N) of the United States and Japan's Astroscale. Unlike Astroscale's technology, which uses magnets to gather up space junk, NEO-01 will use a net to capture debris and then burn it with its electric propulsion system, according to a report on the company's website. Thousands of satellites have been launched globally. As they outlive their use, many end up as junk, posing danger to other operating satellites. Origin Space plans to launch dozens of space telescopes and more spacecraft to achieve the first commercial mining of asteroids by 2045, said the company's founder Su Meng in an interview with domestic media on April 6. Xinhua reported on Saturday that China was stepping up efforts to land a probe on a near-Earth asteroid to collect samples, and also expediting a plan to build a defence system against near-Earth asteroids.

#### Normal means would have safeguards- those solve

Fladeland, 19 -- Fellow at the Outer Space Institute

[Logan, Aaron C. Boley, Michael Byers, Meteoroid Stream Formation Due to the Extraction of Space Resources from Asteroids, Conference paper for the 1st International Orbital Debris Conference, December 2019, <https://arxiv.org/abs/1911.12840>, accessed 6-25-21]

Fortunately, it may be possible to establish simple measures that could mitigate some of these concerns, particularly the formation of debris streams with non-trivial mass fluxes. Examples include establishing an international body with the authority to grant mining permits, much like the International Seabed Authority established under the 1982 United Nations Convention on the Law of the Sea. In any scenario, safety and sustainability requirements should be part of the licensing regime. Some of these requirements could limit mining rates or require a company to produce a risk-to-Earth assessment plan. Some asteroids could even be deemed untouchable for safety or scientific reasons. As space law is redefined in the NewSpace era, it must be fully informed by the astrophysical context.

### Satellites 1NC

#### Obviously can’t solve other issues like space tourism, ASATs testing, or dual-use concerns

#### Russia ASAT testing from this year disproves escalation

#### No one’s going to war over a downed satellite

Bowen 18 [Bleddyn Bowen, Lecturer in International Relations at the University of Leicester. The Art of Space Deterrence. February 20, 2018. https://www.europeanleadershipnetwork.org/commentary/the-art-of-space-deterrence/]

Space is often an afterthought or a miscellaneous ancillary in the grand strategic views of top-level decision-makers. A president may not care that one satellite may be lost or go dark; it may cause panic and Twitter-based hysteria for the space community, of course. But the terrestrial context and consequences, as well as the political stakes and symbolism of any exchange of hostilities in space matters more. The political and media dimension can magnify or minimise the perceived consequences of losing specific satellites out of all proportion to their actual strategic effect.

#### Won’t go nuclear – seen as a normal conventional attack because of integration with ground forces

Firth 7/1/19 [News Editor at MIT Technology Review, was Chief News Editor at New Scientist. How to fight a war in space (and get away with it). July 1, 2019. MIT Technology Review]

Space is so intrinsic to how advanced militaries fight on the ground that an attack on a satellite need no longer signal the opening shot in a nuclear apocalypse. As a result, “deterrence in space is less certain than it was during the Cold War,” says Todd Harrison, who heads the Aerospace Security Project at CSIS, a think tank in Washington, DC. Non-state actors, as well as more minor powers like North Korea and Iran, are also gaining access to weapons that can bloody the noses of much larger nations in space.

#### Empirically no retaliation or escalation from satellite attacks

Eric J. Zarybnisky 18, MA in National Security Studies from the Naval War College, PhD in Operations Research from the MIT Sloan School of Management, Lt Col, USAF, “Celestial Deterrence: Deterring Aggression in the Global Commons of Space”, 3/28/2018, <https://apps.dtic.mil/dtic/tr/fulltext/u2/1062004.pdf>

PREVENTING AGGRESSION IN SPACE While deterrence and the Cold War are strongly linked in the public’s mind through the nuclear standoff between the United States and the Soviet Union, the fundamentals of deterrence date back millennia and deterrence remains relevant. Thucydides alludes to the concept of deterrence in his telling of the Peloponnesian War when he describes rivals seeking advantages, such as recruiting allies, to dissuade an adversary from starting or expanding a conflict.6F6 Aggression in space was successfully avoided during the Cold War because both sides viewed an attack on military satellites as highly escalatory, and such an action would likely result in general nuclear war.7F7 In today’s more nuanced world, attacking satellites, including military satellites, does not necessarily result in nuclear war. For instance, foreign countries have used high-powered lasers against American intelligence-gathering satellites8F8 and the United States has been reluctant to respond, let alone retaliate with nuclear weapons. This shift in policy is a result of the broader use of gray zone operations, to which countries struggle to respond while limiting escalation. Beginning with the fundamentals of deterrence illuminates how it applies to prevention of aggression in space.