## 1

#### Text: The appropriation of outer space within low earth orbit by private entities is just.

[remember that you need to adjust your PIC text based on the aff]

#### That competes –

#### The resolution/plan is entirety of outer space, but CP is only a small portion of space between the Earth and moon, but it’s the most developed and written about portion of the resolution – skirting conversation about the LEO area erases decades of literature.

#### Commercialization of LEO allows government agencies to focus on deep space exploration and makes research for space colonization more efficient

Julie 12/9/21 (Alyssa, International News Producer & Journalist, Global News, "How the Private Space Race is Allowing NASA to Explore New Frontiers," https://globalnews.ca/news/8408558/how-the-private-space-race-is-allowing-nasa-to-explore-new-frontiers/)

In February, NASA will launch the first un-crewed test flight of its Orion spacecraft and SLS rocket as it prepares to send astronauts back to the moon. Artemis I is the first in a series of increasingly complex missions to take place over the next few years. It will be followed by a second crewed test flight and a third flight that will land astronauts on the moon’s south-pole. NASA expects that will be in 2025, at the earliest. The agency says partnerships with private companies like SpaceX will build the lunar lander to ferry astronauts to the moon’s surface, making the Artemis program possible. The private space race has allowed NASA, and agencies like it, to turn their attention from Earth’s lower orbit and start planning for future missions, like Artemis. And as the agency plans to send astronauts to new frontiers, it is encouraging private industry to establish a greater presence in lower-Earth orbit — by collaborating with the private sector on a new space station. The International Space Station is now more than 20 years old, approved for use until 2024, with a likely extension only until the end of 2028 or 2030. NASA’s office of audits released a report at the start of December detailing the “costly repairs” to the orbiting laboratory that have been needed over time. It said maintenance and system upgrades to the ISS increased to approximately $169 billion in 2020. On Dec. 3, NASA announced three U.S. Companies that would receive over $400 million in government funding to develop commercial space stations — Jeff Bezos’ Blue Origin, Nanoracks and Northrop Grumman. Misty Snopkowski, Program Executive for the commercial LEO development program at NASA, says commercial stations, like the one’s these three companies are developing, will help the agency travel deeper into space. “We’re trying to go deeper into space and we can give this very well understood environment in LEO to commercial entities — for them to start establishing that LEO economy,” she says, adding that instead of owner and operator of a new space station, NASA would be one of many customers using the orbiting laboratory. With less of its funding tied up in the International Space Station, the agency will be free to throw more cash at deep space exploration, Snopkowski says. But there is still research that needs to be done in order to make these frontier missions possible. She says the agency has approximately 200 long-term experiments, most of which study the impact of space travel on the human body. The agency needs that work to continue after the International Space Station is decommissioned. “Those types of research, human research, [have] long lead times,” she explains. Such research not only helps further NASA’s ambitions in space, it is also helps us tackle big challenges on Earth, says York University astrophysicist Jesse Rogerson. “Going to the moon and going to Mars is going to push our understanding of how to do agriculture,” he says, as an example of how research in space can help us improve conditions on Earth. “Because we can’t do a permanent settlement on the moon or Mars without ‘living off the land.’ So pushing that science to the very edge so that we can grow something on Mars would inevitably help us do better on Earth.” Canadian astronaut Jeremy Hansen, who acts as CAPCOM at the Canadian Space Agency while he awaits his first flight assignment, says his agency is also involved in discussions about a future commercial space station. In addition to freeing-up funding for future deep space travel, he says such a partnership could reveal new ways to save money on research. “The space agency, we expect, will always be doing research in orbit. But the model on how we do that could change, could create more opportunities and could allow us to do more for less money,” he says. Hansen adds that collaborating with private industry will create more opportunities for astronauts to explore space, a boon for the Canadian Space Agency, whose astronauts have had to wait years to go to space as they wait for a seat to open on a mission. One upcoming mission Canada is taking part in will be Artemis II, the crewed test of the Orion spacecraft that will eventually transport astronauts to the moon. The private space race will also create more opportunities for scientists and astronomers hoping to conduct research in space, Rogerson adds.

#### Space colonization is key to ensure human survival – pursuing it as soon as possible is crucial

Kovic 18 (Marko Kovic, co-founder and president of the thinktank [ZIPAR](https://kovic.ch/zipar/), the Zurich Institute of Public Affairs Research. He is also co-founder and CEO of the consulting firm [ars cognitionis](https://kovic.ch/consulting-ars-cognitionis/),. He has a PhD in political communication, University of Zurich.)(“Why space colonization is so important”, Nov 10, 2018, https://medium.com/@marko\_kovic/space-colonization-why-nothing-else-matters-a877723f77d4)//ASMITH

Should humankind exist in the future? Should the future existence of humankind be as good as possible in as many ways as possible? If your answer to these two questions is Yes, then there is a topic that you should care about a lot: Space colonization. Why, you might wonder, does space colonization matter, possibly more than anything else, as the title of this article claims? Because the future of humankind directly and completely dependent on whether and how we manage to colonize space. Space colonization is a double-edged sword. On one hand, the creation of permanent and self-sustainable human habitats beyond Earth is unavoidable if humankind is to exist in the long-term future. On the other hand, however, space colonization could bring about a catastrophically bad future if we colonize space in a bad way. That future that might be worse than one in which humankind does not exist. Space or bust: Why we must reach for the stars Why should we pursue space colonization in the first place? Don’t we have more pressing problems today, on Earth? Yes, we do have many problems on Earth today, and we should try to solve them. But space colonization is just that: A strategy for dealing with certain problems. An the problems that space colonization would be dealing with are, arguably, among the greatest problems of them all: Existential risks; risks that might lead to the extinction of humankind [1]. Currently, all of our proverbial existential eggs are in the same basket. If a natural existential risk strikes (for example, a large asteroid colliding with Earth) or if a man-made existential risk results in a catastrophic outcome (for example, runaway global warming [2, 3]), all of humankind is at risk because humankind is currently limited to planet Earth. If, however, there are self-sustainable human habitats beyond Earth, then the probability of an irreversibly catastrophic outcome for all of humankind is drastically reduced. Investing in space colonization today could therefore have immense future benefits. Using resources today in order to make space colonization possible in the medium-term future is not a waste, but a very profitable investment. If humankind stays limited to Earth and if we go extinct as a consequence of doing so, then we will all the billions of life years and billions of humans who might have come to exist — and who would have experienced happiness and contributed to humankind’s continued epistemic and moral progress. Taking space colonization more seriously today does not, of course, mean that we should only pursue space colonization and ignore everything else that is bad in the world. We should continue dealing with current global problems and, at the same time, invest greater resources into space colonization. At this point in our history and our technological development, even modest amounts of resources directed at space colonization would go a long way, such as public funding of basic research. Additionally, it is very likely that technological advances in the domain of space colonization would improve our lives in other ways as well thanks to technology transfer [4] — investing in space colonization today would probably be a win-win situation. So the situation seems clear: We must pursue space colonization and try to spread beyond Earth as fast as possible. Unfortunately, there is a catch: Yes, we must colonize space if humankind is to survive, but space colonization itself is very risky. So much so that bad outcomes of space colonization might be even worse for humankind than “merely” going extinct.

## 2

#### CP – The US ought to completely fund the creation and deployment of an International Space Station-mounted laser cannon.

#### Their internal link to space conflict is congestion / rivalrous orbits which is solved completely by this counterplan. The only barrier to the laser cannon is cost

Powell 15

Corey S Powell (science journalist and editor in chief at discover magazine, wrote 3 books with Bill Nye!!), May 20 2015, "Space Junk is a Problem. Is a Laser Cannon the Solution?," https://www.discovermagazine.com/the-sciences/space-junk-is-a-problem-is-a-laser-cannon-the-solution#.VV4ENGRViko, // HW AW, bracketed cause I don’t like reading big numbers

There’s a general rule in media reporting called Betteridge’s Law: Whenever a headline poses a question--especially a sensational one--the answer is “no.” I’m going to break the law this time. **An orbiting laser cannon is not only an intriguing technology but, yes, it’s one of the most promising ways to clean up the ever-thickening cloud of dangerous debris surrounding the Earth**. And just to be clear, space junk is a danger. There are about 25,000 human-made objects larger than your fist flying around in orbit, and about half a million pieces bigger than a dime. If you include millimeter-scale shrapnel, the number of rogue bits reaches deep into the millions. Typical speeds in low-Earth orbit are about 30,000 kilometers per hour (18,000 miles per hour), ten times the velocity of a rifle bullet. You see the problem: A little impact can pack a big wallop. So far, there have not been any space-junk catastrophes remotely resembling the sensationalized events in the movie Gravity, but the reality is still disconcerting. In 2009, a $50 million Iridium communications satellite was destroyed by a collision with a defunct Russian satellite. Three years later, the [Fermi space observatory](https://www.nasa.gov/mission_pages/GLAST/news/bullet-dodge.html) had a near miss with another Soviet-era satellite. NASA had to clad the International Space Station in shielding to protect it from repeated small impacts, and the agency sometimes moves the whole station to dodge larger pieces of junk. Orbiting debris adds cost and risk to the space business.The proposed space-station laser cannon (upper left) would work in conjunction with a telescope called EUSO to track and destroy space debris. (Credit: RIKEN) The amount of junk in orbit is increasing rapidly, meaning that those costs and risks are increasing, too. Once junk gets up there, it takes a long time to come back down: years to centuries in low orbits, and essentially forever in geosynchronous orbit (40,000 kilometers up, where many communications satellites are located). Most disconcerting, collisions in orbit create more junk, which leads to more collisions. Potentially this could lead to a runaway process called [Kessler Syndrome](http://en.wikipedia.org/wiki/Kessler_syndrome). **This is where the laser cannon comes in**. Toshikazu Ebisuzaki and a team of researchers at the RIKEN lab in Japan have [formulated a plan](http://www.riken.jp/en/pr/press/2015/20150421_2/) to clear out near-Earth space by zapping pieces of space junk with a high-power blast of focused radiation. The laser doesn’t need to be able to destroy the whole piece of debris. All it has to do is vaporize enough of the object to slow its orbit and send it spiraling into Earth’s atmosphere, **where it will burn up harmlessly before reaching the ground. It’s an ingenious solution**. Ebisuzaki’s concept was inspired by a science project called the Extreme Universe Space Observatory, currently under development for the International Space Station. [EUSO](http://jemeuso.riken.jp/en/), which will be installed on the station in 2017, is a fascinating instrument in its own right; it will study extremely high-cosmic rays by watching the light they create when they collide with air molecules. But EUSO’s sensitive, wide-field optics also make it well suited to spotting and tracking small bits of space debris, which are hard to locate from the ground. Finding targets is the crucial first step toward getting rid of them. The next step, of course, is the laser. RIKEN’s concept (which is not yet funded) would start with a 10-watt laser prototype, mounted on the International Space Station, capable of firing 100 laser pulses a second. That would pave the way for a larger system powerful enough to blast away any pieces of space junk within a 100-kilometer range, and eventually lead to a dedicated garbage-cleanup satellite equipped with a [five-hundred-thousand]500,000-watt laser that can fire [fifty-thousand]50,000 times per second. Such a satellite could remove 100,000 pieces of junk a year, the Japanese researchers claim, **fast enough to bring the whole orbital debris problem under control.** The fast-growing population of space debris. "LEO" refers to low-Earth orbit. (Credit: Surrey Space Centre) There are significant technical hurdles to overcome, including the data-processing capacity needed to spot the bits of debris and the considerable energy supply needed to keep such a powerful laser operating for years. Building a giant laser-cannon satellite would not be cheap, either. But this is exactly the kind of ambitious thinking needed to tackle the space-junk mess. Several additional cleanup technologies are also under development. A separate Japanese-led team has proposed trapping and eliminating space debris with a huge [electromagnetic tether](http://www.academia.edu/1265073/Space_Demonstration_of_Bare_Electrodynamic_Tape-Tether_Technology_on_the_Sounding_Rocket_S520-25http:/). A European project called [e.DeOrbit](http://www.esa.int/Our_Activities/Space_Engineering_Technology/Clean_Space/How_to_catch_a_satellite) would snare big pieces of space junk using a net or harpoon and dispatch them Earthward. Other concepts under study would use puffs of [pressurized gas](http://www.nasa.gov/directorates/spacetech/niac/gregory_space_debris_elimination.html), large [magnetized nets](http://www.spacesafetymagazine.com/space-debris/debris-removal/electrodynamic-debris-eliminator-receives-funding/), or a [slingshot-style satellite](http://aero.tamu.edu/news/removing-space-debris-tamu-sweeper-sling-sat). The laser cannon has some obvious advantages over all of these options, however. It could tackle the small fry, not just the big pieces, and it could deal with far more targets than would be possible for any spacecraft that is going after them one by one. If all of these ideas sound a little wacky, there's a good reason: Getting rid of space junk is a really, really hard problem. There is a lot of space to scour for debris. The individual pieces are mostly small and nearly invisible, and they each follow a unique orbit. Hard problems call for creative (and sometimes wacky) solutions. Further complicating things, nobody has devoted much money to cleanup, and any mission that can remove space junk could potentially remove active satellites as well--a delicate political issue. **If the RIKEN laser cannon never happens, it will more likely be due to budget** and political **obstacles than to technical ones**. In the long run, the best way to deal with space junk is never to create it in the first place. One of the most important principles here is what is called [design for demise](http://www.esa.int/Our_Activities/Space_Engineering_Technology/Clean_Space/Space_debris_mitigation)--that is, engineering satellites so that they will automatically de-orbit and remove themselves from the trash pile within, say, 25 years of the end of their mission. A simple way to do this is to equip a satellite with a small sail that would pop open when it is no longer needed. The so-called [gossamer sail](https://theconversation.com/cleaning-up-space-debris-with-sailing-satellites-20384) would act like a space parachute, using the pressure of sunlight and the extremely thin traces of atmosphere in orbit to create drag. The drag would then pull the satellite down to a fiery demise. Simulated view of Earth from the Planetary Society's new LightSail, launched on May 20. Space sails could be used to clear away satellite debris--or to take humanity on great ventures of exploration. (Credit: Josh Spradling/Planetary Society) A gossamer sail is very similar in function to a solar sail--like the prototype [LightSail](http://sail.planetary.org/) launched today by the Planetary Society. That creates a neat kind of symmetry to the story. Powerful space lasers may be useful for clearing debris, but they could also be used to launch high-speed spacecraft. Solar sails could be used to de-orbit satellites, but they could also provide new ways to navigate to new worlds. In short, the kinds of technological solutions needed to clear a path through our local garbage dump could be the exact same ones needed to blaze a path to the stars.

#### We’ll go through each of their internal link cards to prove we solve

Santos 13 concedes debris is the internal to sustainability

The long-term sustainability of these activities is currently in danger due to the proliferation of space debris

Manning 21 votes for the counterplan

It would be faster and cheaper if the space-faring states, pooling resources, invited private sector bids for contracts to help rid the lower Earth orbit of dangerous space junk.

Fabian 19 concedes that funding is the problem for tech solutions

Scientific solutions have also been proposed, but technological feasibility and cost remain major problems.

## 3

#### Space-for-space economy is beginning to develop now because of private enterprise in space – They’re going to say “no link because we allow private entities in space” but totally reject that – they’ve given very specific guidelines to what they consider “good” versus “not good” appropriation, and the creation of an entire outer space society and economy obviously falls under the latter because of the potential for collision.

Weinzierl and Sarang 21 (Matt, PhD in Economics Harvard University, Joseph and Jacqueline Elbling Professor of Business Administration at HBS and a Research Associate at the National Bureau of Economic Research, and Mehak, Research Associate at Harvard Business School and the Lunar Exploration Projects Lead for the MIT Space Exploration Initiative, Harvard Business Review, "The Commercial Space Age is Here," 2/12, <https://hbr.org/2021/02/the-commercial-space-age-is-here>)

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.

#### Space-for-space is key for continued space-for-earth developments like asteroid mining

Weinzierl and Sarang 21 (Matt, PhD in Economics Harvard University, Joseph and Jacqueline Elbling Professor of Business Administration at HBS and a Research Associate at the National Bureau of Economic Research, and Mehak, Research Associate at Harvard Business School and the Lunar Exploration Projects Lead for the MIT Space Exploration Initiative, Harvard Business Review, "The Commercial Space Age is Here," 2/12, <https://hbr.org/2021/02/the-commercial-space-age-is-here>)

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.

#### Mining solves extinction from scarcity.

Pelton 17—(Director Emeritus of the Space and Advanced Communications Research Institute at George Washington University, PHD in IR from Georgetown).. Pelton, Joseph N. 2017. The New Gold Rush: The Riches of Space Beckon! Springer. Accessed 8/30/19.

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 artifi cial 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. Th ere 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. Th ese 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 fl oat 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. Th us 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. Th is 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 traffi c control and management, international banking, search and rescue and much, much more depend on application satellites. Th ose that would doubt the importance of satellites to the global economy might wish to view on You Tube the video “If Th ere 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-fi rst 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 fi rst 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 diff erent 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. Th ey, 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. Th e 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. Th is 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 eff orts which we and others call New Space are today being forged by imaginative and resourceful commercial entrepreneurs. Th ese twenty-fi rst 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 redefi ne wealth, change our views of work and employment and upend almost everything we think we know about economics, wealth, jobs, and politics. Th ese 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.

#### Asteroid mining solves water conflict and Kessler syndrome via refueling satellites – turns case

Tillman 19

Nola Taylor Tillman (contributing writer for space.com, loves astronomy and space, and this article cites an asteroid researcher at Johns Hopkins, it is not Nola’s own analysis), 9-29-2019, "Tons of Water in Asteroids Could Fuel Satellites, Space Exploration," Space, https://www.space.com/water-rich-asteroids-space-exploration-fuel.html, // HW AW

When it comes to mining space for water, the best target may not be the moon: Entrepreneurs' richest options are likely to be [asteroids](https://www.space.com/51-asteroids-formation-discovery-and-exploration.html) that are larger and closer to Earth. A recent study suggested that roughly 1,000 water-rich, or hydrated, asteroids near our planet are easier to reach than the lunar surface is. While most of these space rocks are only a few feet in size, more than 25 of them should be large enough to each provide significant water. Altogether, the [water locked in these asteroids](https://www.space.com/how-much-water-in-asteroids.html) should be enough to fill somewhere around 320,000 Olympics-size swimming pools — significantly more than the amount of water locked up at the lunar poles, the new research suggested. Because asteroids are small, they have less gravity than Earth or the moon do, which makes them easier destinations to land on and lift off from. If engineers can figure out how to mine water from these space rocks, they could produce a source of ready fuel in space that would allow spacecraft designers to build [refuelable models](https://www.space.com/orbit-fab-demonstrates-satellite-refueling-technology-on-iss.html) for the next generation of satellites. Asteroid mining could also fuel human exploration, saving the expense of launching fuel from Earth. In both cases, would-be space-rock miners will need to figure out how to free the water trapped in hydrated minerals on these asteroids. "Most of the hydrated material in the near-Earth population is contained in the largest few hydrated objects," Andrew Rivkin, an asteroid researcher at Johns Hopkins University Applied Physics Research Laboratory in Maryland, told Space.com. Rivkin is the lead author on the paper, which estimated that near Earth asteroids could contain more easily accessible water than the lunar poles. Related: [NASA Wants a New Space Telescope to Protect Us All from Dangerous Asteroids](https://www.space.com/nasa-to-build-near-earth-asteroid-hunter-telescope.html) "A sure thing" According to the United Nations Office for Outer Space Affairs, more than 5,200 of the objects launched into space are still in orbit today. While some continue to function, the bulk of them buzz uselessly over our heads every day. **They carry fuel on board, and when they run out, they are either lowered into destructive orbits or left to become** [**space junk**](https://www.space.com/16518-space-junk.html)**, useless debris with the potential to cause enormous problems for working satellites.** [**Refueling satellites in space**](https://www.space.com/8339-wet-asteroid-space-gas-station.html) **could change that model, replacing it with long-lived, productive orbiters.** "It's easier to bring fuel from asteroids to geosynchronous orbit than from the surface of the Earth," Rivkin said. "If such a supply line could be established, it could make [asteroid mining](https://www.space.com/39363-planetary-resources-asteroid-mining-satellite-launches.html) very profitable." Hunting for space water from the surface of the Earth is challenging because the planet's atmosphere blocks the wavelength of light where water can be observed. The asteroid warming as it draws closer to the sun can also complicate measurements. Instead, Rivkin and his colleagues turned to a class of space rocks called Ch asteroids. Although these asteroids don't directly exhibit a watery fingerprint, they carry the telltale signal of oxidized iron seen only on [asteroids](https://www.space.com/51-asteroids-formation-discovery-and-exploration.html) with signatures of water-rich minerals, which means the authors felt confident assuming that all Ch asteroids carry this rocky water. Based on meteorite falls, a previous study estimated that Ch asteroids could make up nearly 10% of the [near-Earth objects](https://www.space.com/nasa-to-build-near-earth-asteroid-hunter-telescope.html) (NEOs). With this information, the researchers determined that there are between 26 and 80 such objects that are hydrated and larger than 0.62 miles (1 km) across. Right now, only three NEOs have been classified as Ch asteroids, although others have been spotted in the asteroid belt. Most NEOs are discovered and observed at wavelengths too short to reveal the iron band that marks the class. Carbon-rich asteroids, which include Ch asteroids and other flavors, are also darker than the more common stony asteroids, making them more challenging to observe. Although Ch asteroids definitely contain water-rich minerals, that doesn’t necessarily mean that they will always be the best bet for space mining. It comes down to risk. Would an [asteroid-mining](https://www.space.com/moon-asteroid-space-mining-with-concentrated-sunlight.html) company rather visit a smaller asteroid that definitely has a moderate amount of water, or a larger one that could yield a larger payday but could also come up dry? "Whether getting sure things with no false positives, like the Ch asteroids, is more important or if a greater range of possibilities is acceptable with the understanding that some asteroids will be duds is something the miners will have to decide," Rivkin said. Not too big, not too small In addition to estimating the number of large, water-rich asteroids might be available, the study also found that as many as 1,050 smaller objects, roughly 300 feet (100 meters) across, may also linger near Earth. Their small bulk will make them [easier to mine](https://www.space.com/30213-asteroid-mining-planetary-resources-2025.html) because their low gravity will require less fuel to escape from, but they will produce less water overall, and Rivkin expects that the handful of larger space rocks will be the first targets. "It seems likely that the plan for these companies will be to find the largest accessible asteroid with mineable material with the expectation that it will be more cost-effective than chasing down a large number of smaller objects," Rivkin said. "How 'accessible' and 'mineable material' and 'cost-effective' are defined by each company is to be seen." But asteroids will certainly be more accessible than the moon, another [potential source](https://www.space.com/41164-mining-moon-water-plans-take-shape.html) of space-based water-rich minerals. According to Rivkin, landing safely on the lunar surface takes more than a hundred times the change of velocity required to land on an asteroid. Similarly, taking off from the moon means breaking free from its gravity, requiring even more fuel. "Even asteroids that are a bit farther from the Earth than the moon can be reached with less fuel than the lunar surface," Rivkin said.

#### Global water war is inevitable in the squo – extraction, climate change, drought – best analysis

Milne 21

Sandy Milne (austrailian journalist, has written a whole lot of articles about austrialian military), 16 aug 21, "How water shortages are brewing wars," BBC, https://www.bbc.com/future/article/20210816-how-water-shortages-are-brewing-wars, // HW AW

\*\*brackets in original

**Unprecedented levels of dam building and water extraction by nations on great rivers are leaving countries further downstream increasingly thirsty, increasing the risk of conflicts**. Speaking to me via Zoom from his flat in Amsterdam, Ali al-Sadr pauses to take a sip from a clear glass of water. The irony dawning on him, he lets out a laugh. "Before I left Iraq, I struggled every day to find clean drinking water." Three years earlier, al-Sadr had joined protests in the streets of his native Basra, demanding the authorities address the city's growing water crisis. "Before the war, Basra was a beautiful place," adds the 29-year-old. "They used to call us the Venice of the East." Bordered on one side by the Shatt al-Arab River, the city is skewered by a network of freshwater canals. al-Sadr, a dockhand, once loved working alongside them. "But by the time I left, they were pumping raw sewage into the waterways. We couldn't wash, the smell [of the river] gave me migraines and, when I finally fell sick, I spent four days in bed." In the summer of 2018, tainted water sent [120,000 Basrans to the city's hospitals](https://news.yahoo.com/more-basra-water-crises-unless-iraq-govt-fixes-090656526.html) – and, when police opened fire on those who protested, al Sadr was lucky to escape with his life. "Within a month I packed my bags and left for Europe," he says. Around the world, stories like al Sadr's are becoming far too common. As much as a quarter of the world's population now [faces severe water scarcity](https://news.trust.org/item/20200902202142-ku0o2) at least one month out of the year and – as in al-Sadr's case – it is leading many to seek a more secure life in other countries. "If there is no water, people will start to move," says Kitty van der Heijden, chief of international cooperation at the Netherlands' foreign ministry and an expert in hydropolitics. **Water scarcity affects roughly 40% of the world's population and, according to predictions by the United Nations and the World Bank, drought could put up to** [**700 million people at risk of displacement**](https://www.unccd.int/actions/drought-initiative) **by 2030**. People like van der Heijden are concerned about what that could lead to. "If there is no water, politicians are going to try and get their hands on it and they might start to fight over it," she says. Over the course of the 20th Century, global water use grew at more than twice the rate of population increase. Today, **this dissonance is leading many cities – from** [**Rome**](https://www.bbc.com/news/world-europe-41081066) **to** [**Cape Town**](https://www.wri.org/insights/3-things-cities-can-learn-cape-towns-impending-day-zero-water-shut)**, [Chennai](https://www.npr.org/sections/goatsandsoda/2019/06/25/734534821/no-drips-no-drops-a-city-of-10-million-is-running-out-of-water?t=1626365858497) to** [**Lima**](http://news.bbc.co.uk/1/hi/world/americas/3697647.stm) **– to ration water. Water crises have been ranked in the top five of the World Economic Forum's** [**Global Risks by Impact**](http://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2021.pdf) **list nearly every year since 2012**. In 2017, severe droughts contributed to the [worst humanitarian crisis since World War Two](https://www.un.org/press/en/2017/sc12748.doc.htm), when 20 million people across Africa and the Middle East were forced to leave their homes due to the accompanying food shortages and conflicts that erupted. Peter Gleick, head of the Oakland-based Pacific Institute, has spent the last three decades studying the link between water scarcity, conflict and migration and believes that water conflict is on the rise. "With very rare exceptions, no one dies of literal thirst," he says. "But more and more people are dying from contaminated water or conflicts over access to water." Falling water quality around Basra, southern Iraq, has been exacerbated by reduced river flows due to damming in Turkey (Credit: Haidar Mohammed Ali/AFP/Getty Images) Gleick and his team are behind the [Water Conflict Chronology](http://www.worldwater.org/conflict/map/): a log of 925 water conflicts, large and small, stretching back to the days of the Babylonian king Hammurabi. It is not, by any means, exhaustive and the conflicts listed vary from full blown wars to disputes between neighbours. But what they reveal is that the relationship between water and conflict is a complex one. "We categorised water conflicts in three groups," says Gleick. "As a 'trigger' of conflict, where violence is associated with disputes over access and control of water; as a 'weapon' of conflict, where water or water systems are used as weapons in conflicts, including for the use of dams to withhold water or flood downstream communities; and as 'casualties' or 'targets' of conflicts, where water resources or treatment plants or pipelines are targeted during conflicts." Leaf through the records he and his colleagues have compiled, however, and it becomes clear that the bulk of the conflicts are agriculture-related. It's perhaps not surprising as agriculture [accounts for 70%](https://www.worldbank.org/en/topic/water-in-agriculture#:~:text=Currently%2C%20agriculture%20accounts%20(on%20average,to%20the%20evapotranspiration%20of%20crops).) of freshwater use. In the semi-arid Sahel region of Africa, for example, there are regular reports of herdsmen and crop farmers clashing violently over scarce supplies of water needed for their animals and crops. But as demand for water grows, so too does the scale of the potential conflicts. You might also like: [The city running out of water](https://www.bbc.com/future/article/20181011-how-to-solve-delhis-water-crisis) [How long can you survive without water?](https://www.bbc.com/future/article/20201016-why-we-cant-survive-without-water) [The megacity digging a million wells](https://www.bbc.com/future/article/20201006-india-why-bangalore-is-digging-a-million-wells) "The latest research on the subject does indeed [show water-related violence increasing over time](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3076402/)," says Charles Iceland, global director for water at the World Resources Institute. "Population growth and economic development are driving increasing water demand worldwide. Meanwhile, climate change is decreasing water supply and/or making rainfall increasingly erratic in many places." Nowhere is the dual effect of water stress and climate change more evident than the wider Tigris-Euphrates Basin – comprising Turkey, Syria, Iraq and western Iran. According to satellite imagery, the region is [losing groundwater faster than almost anywhere else in the world](https://www.stimson.org/2021/joint-working-group-on-international-and-eu-water-diplomacy-in-focus-the-euphrates-tigris-river-basin/). And as some countries make desperate attempts to secure their water supplies, their actions are affecting their neighbours. India's Northern Plains are one of the most fertile farming areas in the world, yet today, villagers regularly clash over water scarcity During June 2019, as Iraqi cities sweltered through a [50C (122F) heatwave](https://www.independent.co.uk/climate-change/news/climate-change-apartheid-poor-iraq-effects-heatwave-a9049206.html), Turkey said it would [begin filling its Ilisu dam](https://www.reuters.com/article/us-turkey-dam-idUSKCN1US194) at the origins of the Tigris. It is the latest in a long-running project by Turkey to build 22 dams and power plants along the Tigris and the Euphrates that, according to a report by the French International Office for Water, is significantly [affecting the flow of water into Syria, Iraq and Iran](https://www.oieau.org/eaudoc/system/files/documents/40/204634/204634_doc.pdf). It claims that when complete Turkey's Guneydogu Anadolu Projesi (GAP) could include as many as [90 dams and 60 power plants](https://www.oieau.org/eaudoc/system/files/documents/40/204634/204634_doc.pdf). (See [how dams such as the Ilisu are reshaping our planet](https://www.bbc.com/future/article/20201021-how-dams-have-reshaped-our-planet).) As water levels behind the mile-wide Ilisu dam rose, [the flow from the river into Iraq halved](https://www.independent.co.uk/news/world/middle-east/iraq-water-rivers-shortage-drought-baghdad-war-isis-a8426766.html). Thousands of kilometres away in Basra, al-Sadr and his neighbours saw the [quality of their water deteriorate](https://www.hrw.org/report/2019/07/22/basra-thirsty/iraqs-failure-manage-water-crisis). In August, hundreds of people began pouring into Basra's hospitals suffering from rashes, abdominal pain, vomiting, diarrhoea, and even cholera, [according to Human Rights Watch](https://www.hrw.org/report/2019/07/22/basra-thirsty/iraqs-failure-manage-water-crisis). "There's actually two parts to the story in Basra," Iceland says. "Firstly, you have the obvious discharge of wastewater into local waterways without any treatment. But you've also got to consider the damming at the Turkish border – with less freshwater flowing down the Tigris and Euphrates, saltwater is intruding further up the river (from the Persian Gulf). Over time, it's ruining crops and it's making people sick." It's a complicated picture, but this ability to see links between the seemingly disparate has informed Iceland's work with the Dutch government-funded Water, Peace and Security (WPS) partnership, a group of six American and European NGOs (including the Pacific Institute and the World Resources Institute). They've developed a [Global Early Warning Tool](https://waterpeacesecurity.org/map), which uses machine learning to predict conflicts before they happen. It combines data about rainfall, crop failures, population density, wealth, agricultural production, levels of corruption, droughts, and flooding, among many other sources of data to produce conflict warnings. They are displayed on a red-and-orange Mercator projection down to the level of administrative districts. Currently it is warning of around 2,000 potential conflict hotspots, with an accuracy rate of 86%. (Read more about [how AI can help to identify conflicts before they happen](https://www.bbc.com/future/article/20190219-how-artificial-intelligence-could-unlock-world-peace).) The Indus River is a vital water source for northern India and Pakistan, but originates in the mountains of Tibet that are controlled by China (Credit: Nadeem Khawar/Getty Images) But while the WPS Tool can be used to identify locations where conflicts over water are at risk of breaking out, it can also help to inform those hoping to understand what is happening in areas that are already experiencing strife due to water scarcity. India's Northern Plains, for example, are one of the most fertile farming areas in the world, yet today, [villagers regularly clash over water scarcity](https://www.thekashmirmonitor.net/2-haryana-villages-clash-over-water-8-bikes-set-on-fire-12-injured/). The underlying data reveals that population growth and high levels of irrigation have outstripped available groundwater supplies. Despite the area's lush-looking cropland, the WPS map ranks nearly every district in Northern India as "extremely high" in terms of baseline water stress. Several key rivers which feed the area – the Indus, Ganges and Sutlej – all originate on the Tibetan side of the border yet are vital for water supplies in both India and Pakistan. compounds the problem. Several border skirmishes have broken out recently between India and China, which lays claim to upstream areas. A violent clash in May last year in the Galwan Valley, through which a tributary to the Indus flows, left 20 Indian soldiers dead. Less than a month later there were reports that China was building "structures" that might dam the river and so restrict its flow into India. But the data captured by the Global Early Warning tool also reveals some strange trends. In some of the most water-stressed parts of the world, there appears to be a net-migration of people into these areas. Oman, for example, suffers higher levels of drought than Iraq but received hundreds of thousands of migrants per year prior to the pandemic. That's because Oman fares far better than the latter in terms of corruption, water infrastructure, ethnic fractionalisation, and hydropolitical tension. "A community's vulnerability to drought is more important than the drought itself," says Lina Eklund, of a physical geography researcher at Sweden's Lund University

## 4

#### Private companies alone put the US ahead of China in the space race – China isn’t dependent at all on the private sector

Grieco 1-19

Kelly A. Grieco, PhD in polisci @ MIT, senior fellow at the New American Engagement Initiative at the Atlantic Council’s Scowcroft Center for Strategy and Security, 1-19-2022, "The China-US Space Race Is a Myth," The Diplomat, <https://thediplomat.com/2022/01/the-china-us-space-race-is-a-myth/> //MLT

Seventy years later, it is happening again. Pundits, politicians, and senior military officers alike now warn the United States is losing a space race to China. “We are absolutely in a strategic competition with China and space is a part of that,” Gen. David D. Thompson, vice chief of space operations for the U.S. Space Force, warned recently. “The fact, that in essence, on average, they are building and fielding and updating their space capabilities at twice the rate we are means that very soon, if we don’t start accelerating our development and delivery capabilities, they will exceed us.” Space alarmism makes great headlines. But the United States is not falling behind China in space – quite the contrary. The United States remains the most advanced space power in the world. Of the more than 4,500 satellites in orbit today, the United States accounts for more than half of them, some 2,700 satellites and nearly seven times as many as the next competitor, China. True, the Chinese hold the record for the most space launches in 2021 – a total of 55 launches to the United States’ 51. But the number of launches only tells part of the story, because the United States has more powerful rockets, able to deliver more payloads – satellites, space probes, and spacecraft – into orbit. China’s space funding has increased markedly in recent years, to $8.9 billion in 2020, but it still spent a mere fraction of the United States’ $48 billion. **The U.S. also boasts a booming commercial space industry, with hundreds of startups joining leading firms like Blue Origin and SpaceX, and investors pouring billions of dollars into the U.S. space economy**. Meanwhile, **China’s private space industry lags behind** American companies and, last year, funding trended in the wrong direction. China’s space program has made significant advances in recent years, from completing its own global satellite navigation system and collecting lunar samples to landing a spacecraft on Mars and sending astronauts to its own space station. But these milestones should serve as a reality check: The United States is not falling behind in the space race, so much as China is steadily catching up after having started so far behind. Likewise, China’s space ambitions are impressive, with plans to develop satellite mega-constellations and further explore the moon and deep space, but each of these Chinese space endeavors will need to first clear significant technical and other obstacles. For example, in June, Beijing released a roadmap for an International Lunar Research Station to be developed jointly with Russia. This plan requires China to field the Long March 9, a super heavy-lift rocket that has been in the research-and-development phase since 2011. The Chinese expect it to make its first test flight around 2030, but their troubles with other heavy rockets suggest that ambitious goal could well be pushed back. Even then, China landing its astronauts on the moon hardly constitutes a great victory. After all, the United States won that race back in 1969.

#### **NASA is on the decline – private companies are the US’s only hope**

Nguyen 21 Hanh Nguyen-Le is a second-year Master of Public Administration student at the London School of Economics. She is also the Government Affairs Associate at the Space Foundation, a nonprofit advocate organization for space exploration and space-inspired industries, where she focuses on U.S. Congressional relations and national space policy. “Billionaire Private Investment Is Good for the Space Industry, Whether We like It or Not.” 2021. USAPP. July 19, 2021. https://blogs.lse.ac.uk/usappblog/2021/07/19/billionaire-private-investment-is-good-for-the-space-industry-whether-we-like-it-or-not/.///WL

On 11 July UK billionaire businessman Richard Branson travelled to the edge of space in a spaceplane developed by his company, Virgin Galactic. On Tuesday this week, the billionaire founder of Amazon, Jeff Bezos, will take a similar trip to space aboard the New Shepherd rocket built by his Blue Origin company. Elon Musk’s SpaceX will soon begin sending paying civilians into Earth orbit with the company’s Falcon 9 rocket. The ability of such billionaires to afford private spaceflight trips or invest in heavy-lift rockets, while paying a smaller fraction of income in tax than the average American, reflects inequality in America. This inequality has been made especially stark during the COVID-19 pandemic with billionaires’ wealth increasing while many others experienced financial hardships. Increasing wealth and reaching for space has not purchased popularity for these billionaires. Ahead of Bezos’ upcoming suborbital flight, a petition to “not allow Bezos to return to Earth” gained more than 160,000 signatures. Richard Branson has been criticized for using his wealth to go to space rather than addressing more terrestrial problems like climate change. But after half a century of government-led exploration beyond earth, why are billionaires now at the forefront of our minds when we think about space travel, and what do they mean for how we go to space? The private sector has always had a close involvement with space Billionaire interest in space is not new. Historically, science research funding for observatories in the 19th and 20th centuries was typically provided through endowments from wealthy individuals. Institutions such as the Smithsonian and the Guggenheim family were the early donors of Robert Goddard’s ambitious projects to develop rockets and space technology. Following 1980s initiatives like MirCorp’s plan to provide privately owned space stations, the 1990s and 2000s saw commercial space efforts like Peter Diamandis’ introduction of the Ansari X Prize (1996), the US government’s Alternate Access to [the International Space] Station Program (2000-2002), and the founding of Mojave Aerospace Ventures (2004). Between 2001 and 2009 seven wealthy people went to space as paying customers on Russian Soyuz rockets including Dennis Tito, Iranian American businesswoman Anousheh Ansari and Cirque du Soleil founder Guy Laliberte. More recently, aside from Jeff Bezos and Richard Branson, other billionaires have also planned trips to space, including Jared Isaacman and Yusaku Maezawa. The wave of billionaires now seemingly interested in space exploration is a return to a past trend. Space exploration is expensive Private actors and the government think differently when it comes to what type of space programs to prioritize. The government prioritizes aspects of a space program that are in the public-interest such as national security and Earth sciences, while wealthy individuals that enter the space sector are interested in personal and financial endeavors that involve space exploration, such as making life multiplanetary for Elon Musk and space tourism for Richard Branson and Dennis Tito. The Apollo program which ultimately sent astronauts to the moon in 1969 is thought of as the height of US government leadership in space. But the massive investment which made the first moon landing possible was an anomaly that had been driven by political necessity given the climate of the Cold War. As Figures 1 and 2 show, by 1965, the US government had begun to cut NASA’s budget to the point that by the 1970s it made up only about 0.5-1 percent of the total federal budget. According to Dr. John Logsdon of George Washington University’s Space Policy Institute: “From 1970 onward, NASA has not had a budget adequate to support a robust program of human exploration.” Figure 1 – NASA’s budget from 1959 – 2025 Source: The Space Report Figure 2 – NASA’ share of US federal Budget 1959-2018 Source: The Space Report The lackluster interest in space exploration by the US government since the 1970s sits alongside with a similar lack of enthusiasm by the American public. In a 2018 survey conducted by Pew Research Center, a majority of American adults believed that that monitoring Earth’s climate system should be the highest priority and sending astronauts to Mars and the Moon the lowest (Figure 3). Figure 3 – Americans’ views on policy priorities Source: Pew Research Center, 2018 Re-emergence of commercial space At the same time, many wealthy individuals have been dissatisfied with the lack of public enthusiasm and the lack of progress in recent years due to the government’s traditional view of space operations, and failures of the Space Shuttle. Wealthy individuals like Musk believed that they could spur a robust marketplace for providing access to space which could work alongside and provide services for government space agencies by leveraging reusable technologies, lean manufacturing, and vertically integrated production to enable cheap space access. Because typical debt and equity investors are unwilling to finance the risks of space exploration and the government is unable or uninterested in large up-front investments, it is natural for private space exploration to be funded out of billionaire’s own wealth initially, with government support through development contracts. Government support and US Commercial Space Policy Without the government, the private sector cannot thrive in space. The government supports the private sector by adopting regulatory reforms or creating contracts and awards. Early attempts to invigorate the commercial space industry include the 1984 Commercial Space Launch Act, which was unsuccessful as US launch firms were unable to compete against NASA’s Space Shuttle. President Reagan’s 1986 US Space Launch Strategy reduced NASA’s ability to provide commercial launches, which led to the re-emergence of commercial space activities. The limitations provided by the 1986 policy led to the first commercial space launch by Space Services, Inc. in 1989. The US government under the Obama administration made policy reforms such as introducing fixed price contracting to support development of commercial services. An example of this was a request for over $6 billion to subsidize commercial crew vehicles to visit the International Space Station for the Commercial Crew Resupply (CRS) program. Congressional appropriators in the Senate created a “Dual-track” approach, exemplified by the 2010 NASA Authorization Act, which calls for commercial cargo development. The bill shows that policymakers were willing to compromise on certain aspects of the space program such as CRS to support private space launch companies. By 2010, commercialization was well underway with Obama’s National Space Policy that emphasized supporting a “competitive US commercial space sector.” As of 2011, NASA had paid SpaceX $181 million for 14 Commercial Resupply Missions and $298 million under the Commercial Orbital Transportation Services Demonstration Agreement. The Trump Administration increased public investment in private space actors further and established a series of Space Policy Directives that were meant to bolster the commercial sector. Government support to the private sector further comes in the form of NASA- approved loans, loan guarantees, and tax credits. Firms can also receive tax exemptions through facility constructions, discounted loans, and environmental credits. It is estimated that all of Musk’s ventures, not limited to SpaceX, received at least $4.9 billion in government support through tax breaks, factory construction, discounted loans, environmental credits, facility loans, and rebates to product buyers. Photo by SpaceX on Unsplash How billionaires support the space industry Private investment in space has created competition and reduced space launch costs. New space actors began to challenge the government-created monopoly, United Launch Alliance (ULA), for contracts, creating competition and introducing a market for small-medium class reusable launch. SpaceX’s Falcon 9’s average cost is $62 million, while ULA’s Atlas V starts at $110 million per launch. Commercial actors enable the government to have multiple competitive proposals to select from during project development. NASA would pay less money upfront for a service, while private companies can operate and have autonomy over their final product. The government can act as a buyer of commercial services, which allows NASA to be more efficient and cost-effective, as the agency can cut costs by only developing projects it has expertise and funding for. Such competition has dramatically changed space technology. New players that enter the space industry are able to embark on ambitious projects at a greater scale and faster pace. Innovative concepts such as reusable rocket stages has shifted the launch industry into integrating reusability into vehicle design and the proliferation of ridesharing missions has decreased the costs of space launch. This has lowered barriers to enter the space industry, making small satellites rideshare as low as $1 million per mission. Innovations in space launch have further changed the policy environment and streamlined launch and reentry regulations. Billionaires in space are here to stay Investment from wealthy individuals in recent decades have stimulated private markets and paved the way for many startups to enter the industry. As more new players join the commercial space industry, access to space becomes cheaper, resulting in an explosion of proposed satellite constellations and small launch vehicle concepts. Wealthy entrepreneurs have seen an opportunity to take advantage of a lack of government interest in space exploration funding. The high-risk nature of space exploration requires substantial upfront investment that only wealthy individuals can provide before any pay-off. Private investments in space promote competition and innovation. Billionaires providing upfront investments has stimulated the space market and made space more accessible – and profitable.

#### **Being a space innovation leader ensures economic dominance and US primacy**

Beames 21 Charles Beames is executive chairman and chief strategy officer of Colorado-based York Space Systems and chairman of the SmallSat Alliance.“Opinion: The Innovation That Will Ensure U.S. Security in Space | Aviation Week Network.” Aviationweek.com, 1/28/2021. https://aviationweek.com/aerospace/commercial-space/opinion-innovation-will-ensure-us-security-space. //WL

During the Cold War, it was not the U.S.’ superior weapons or soldiers that ultimately led to the Soviet Union’s capitulation. Historians record that the relative economic might of the U.S. ultimately brought the Cold War to a peaceful and conclusive end. Three decades later, the U.S. again finds itself at the dawn of what many have dubbed the “Second Space Race,” for which the U.S. ought to remain mindful of this lesson, lest it be used against us. The West is once again threatened by a hegemonic national security rival. This time, America’s archnemesis is characterized by planning for a long contest that will feature fast-forward economics, global diplomacy, military muscle and information manipulation: China, it appears, is preparing to use its economic power to win. While maintaining its deep belief in Marx’s communist vision, the Chinese one-party government has fashioned a national economy that learned from the Soviet Union’s mistakes. Through friendly engagement with Western economies, China strengthens its own economy and weakens the West’s, nudging the world toward the worldview of the Chinese Communist Party. What then, are the best avenues for the U.S. to win this new near-peer space competition? They are the same ones that delivered victory in the last century: free markets, real economic growth and the productivity that often follows. This time, however, we must keep in mind that our rival is a keen student that has learned from our earlier successes—and Soviet failures. The American response must not repeat the Cold War strategy of outspending our rival in government programs. Instead, the U.S. long game must put the commercial industry first: deliberately buy goods and services from our commercial domestic market, only providing government solutions when the commercial market cannot meet requirements. Unlike other military services, there are no real “weapons” in space. Much of what the government is developing for civil and national security space needs also exists as products or services in the commercial market. By encouraging the commercial industry to grow and not competing against it, the U.S. will secure a long-term strategy leading to unrivaled space leadership. The U.S. economy has generated growth and prosperity unmatched in human history, with billions of dollars being invested every year into profitable commercial space companies. To outpace China militarily and economically, the new administration must double down on space privatization projects like NASA’s Commercial Crew and Commercial Resupply Programs started under the Obama administration. The Trump administration correctly reprioritized the importance of space for national security, but it directed too much government spending to legacy space projects and fell short in encouraging the next generation of commercial space companies. An American “commercial first” policy for space technologies can solve government needs at the federal and state levels, which account for about half of commercial space company revenue. By prioritizing the highly competitive commercial sector, the government will bolster U.S. competitiveness without illegally subsidizing it. More important, it would reinforce the American values of free markets and open competition. As the new administration settles in, national security political insiders are already hedging their bets on who and what will be the winners and losers of the new political cycle. This is especially true for the space sector, not only because it was an area of significant emphasis during the last administration but also because there continues to be significant private investment and anticipated growth in the area. The unrelenting march of the knowledge economy and remarkable utility of the commercial space industry is limited only to our imaginations. The new U.S. Space Force and other civil space agencies will be better positioned if they leverage the burgeoning industry and do not overshadow it with government alternatives. If, however, the government decides to compete against the private sector with its top-down directed design methods and protocols, our commercial industry will be lost to China, much like the drone market was just a decade ago. Economic dominance in the space industry, not space weapons, will ultimately decide which side defines the 21st-century space domain and the national security implications that come with it. America must strategically rethink policies that will take advantage of, rather than compete against, its blossoming commercial space industry. Getting space policy right—commercial industry first and using government solutions only when necessary—will lead to explosive growth. Getting policy wrong? Well, just ask the Soviets.

#### U.S. global primacy is key to stop every existential risk – reject old defense that doesn’t assume new threats, tech, and tactics.

#### Don’t let them impact turn heg – Johnson 13 concedes heg good it talks about how the us military is based in space and keeping it is good – that concedes both the link and impact of the DA

Edelman, PhD, and Roughead et al. 18

(Co-chairs: Eric, USDiplomaticHistory@Yale, FormerUSAmbassador, Gary, FormerUSAdmiral/ChiefOFNavalOperations Fellow@Hoover, Authors: Christine Fox, FormerDeuptySecrataryOfDefense, Kathleen Hicks, PhD PoliSci@MIT, DirectorInternationalSecurity@CSIS, Jack Keane, Retired-4StarGeneral, FormerViceCheifOfStaff-Army, HonPhD PublicService@EasternKentucky, Andrew Krepinevich, PhD Harvard, President@CenterForStrategicAndBidgetaryAssesments, RetiredArmyLt.Col., Jon Kyl, FormerArizonaSenator, JD@UArizona, Thomas Mahnken, PhD InternationalAffairs@JohnsHopkins, ProfStrategicStudies@JohnsHopkins, MA PublicPolicy@Penn, FormerDOD-UndersecrataryOfDefense+CFO, Michael Morell, FormerDirectorOfTheCIA, MA Econ@Gtown, Anne Patterson, FormerUSAmbassador, FormerAssistSecrataryOfState-NearEasternAffairs, Roger Zakheim, MPhil IR@Cambridge, FormerDepAssistSecrataryOfDefense, FormerDeputyStaffDirector-USHouseArmedServicesCommitee, Providing for the Common Defense: The Assessment and Recommendations of the National Defense Strategy Commission, United States Institute of Peace)

Our specific findings are outlined in the text. But at the outset, we wish to underscore the central theme of this report: There is a need for extraordinary urgency in addressing the crisis of national defense. We believe that the NDS is a broadly constructive document that identifies most of the right objectives and challenges. Yet we are deeply concerned that the Department of Defense and the nation as a whole have not yet addressed crucial issues such as force sizing, developing innovative op- erational concepts, readiness, and resources with the degree of urgency, persistence, and analytic depth that an increasingly dangerous world demands. Put bluntly, the American people and their elected representatives must understand that U.S. military superiority is not guaranteed, that many global trends are adverse and threatening, and that the nation has reached a pivotal moment regarding its ability to defend its vital interests and preserve a world in which the United States and other like-minded nations can thrive. The choices we make today and in the immediate future will have profound and potentially lasting consequences for American security and influence. If we do not square up to the challenge now, we will surely regret it.1 Chapter 1 The Purpose of American Military Power and the Crisis of National Defense Any defense strategy must protect the fundamental interests of the United States. Since the inception of the Republic, America’s most vital interests have remained constant. They include the physical security of the United States and its citizens; the promotion of a strong, innovative, and growing U.S. economy; and the protection of the nation’s democratic freedoms and domestic institutions. These interests were enshrined in the Declaration of Independence as “life, liberty, and the pursuit of happiness,” and collectively, they represent the pole star toward which any American strategy must be oriented. Since the mid-20th century, there has been a bipartisan consensus that America should take an international leadership role to secure these interests. The events of the 1930s and 1940s showed that the United States could not remain prosperous in a world ravaged by global depression, nor could it remain safe in a world convulsed by instability and war. Moreover, these events illustrated to Americans the danger that their own free institutions might not survive in a world ruled by hostile autocracies. As a result, Americans and their elected leaders concluded that the United States must use its unmatched power to foster a larger global environment in which America could thrive. This endeavor has often been referred to as building the “liberal international order,” but it simply reflects the common-sense idea that America will be most secure, prosperous, and free in a world that is itself secure, prosperous, and free. This straightforward judgment has underpinned the sustained global leadership the United States has exercised since the 1940s. America has anchored an open global economy in which trade and investment flow freely and Americans can see their creative energies rewarded. It has built international institutions that facilitate problem-solving and cooperation on important global issues. It has defended democratic values and human rights abroad in order to enhance U.S. influence and safeguard democratic values and human rights at home. It has sought to uphold favorable balances of power in key regions and concluded military alliances and security partnerships with dozens of like-minded countries— not as a matter of charity, but as a way of deterring aggression and preventing conflicts that could pose a serious threat to U.S. national security and prosperity. These have not been Republican policies or Democratic policies; they have been American policies, meant to create a world conducive to American interests and values. The role of alliances and partnerships deserves special emphasis here. U.S. alliances and partnerships are sometimes mischaracterized as arrangements that squander American resources on behalf of free-riding foreign countries. In reality, U.S. alliances and partnerships have been deeply rooted in American self-interest. They have served as force-multipliers for U.S. influence, by promoting institutionalized cooperation between America and like-minded nations. They have allowed America to call on the aid of its friends in every major conflict it has waged since World War II. They have buttressed the concept of international order that the United States seeks to preserve, by enlisting other nations in the promotion of a world favorable to American interests. They have provided intelligence support, regional expertise, and other critical assistance. In short, alliances and partnerships rooted in shared interests and mutual respect have reduced the price America pays for global leadership and enhanced the advantages America enjoys over any geopolitical rival. And although these alliances and partnerships—like all of America’s postwar policies—have required the persistent use of diplomacy, economic power, and other tools of statecraft, they have ultimately rested on a foundation of military strength. Since World War II, America has had a military second to none. After the Cold War, it possessed military power far greater than that of any rival or group of rivals. This position of unmatched strength has provided for the defense and security of the United States, American citizens overseas, and American allies and partners. It has been crucial to deterring and, if necessary, defeating aggression by hostile powers, whether the Soviet Union and its allies during the Cold War or al-Qaeda and Islamic State in Iraq and al-Sham (ISIS) more recently. It has preserved stability in key regions from Europe to East Asia and beyond, and ensured the freedom of the global commons on which U.S. and international prosperity depends. It has prevented America from being coerced or intimidated, or once again finding itself the situation of the early 1940s, when democracy itself was endangered because aggressive authoritarian powers were on the verge of dominating the globe. It has given the United States unrivaled influence on a wide range of global issues. America’s leadership role has never been inexpensive or easy to play, and today many Americans are questioning whether it is worth the cost. But by any reasonable standard, U.S. global engagement has been a great investment. U.S. leadership has prevented a recurrence of the devastating world wars that marked the first half of the 20th century and required repeated U.S. interventions at a cost of hundreds of thousands of American lives. That leadership has also fostered an unprecedented growth in human freedom, with the number of democracies rising from roughly a dozen during World War II to 120 in the early 21st century. And as democracies displaced dictatorships, America itself became more secure and influential. The growth of prosperity has been even more astounding. According to World Bank data, inflation-adjusted U.S. gross domestic product has increased nearly six-fold since 1960. Both U.S. and global per capita income have also increased roughly three-fold (also in inflation-adjusted terms) over the same period. To be clear, the evolution of the economy in recent decades has left too many of our citizens behind, and it is essential that all benefit from our national prosperity. On the whole, however, both the United States and the world are far richer than they would have been absent the open international economy America has fostered. Here, too, American policy has been successful in what it has avoided as well as what it has achieved: the world has not suffered another global depression that would cause rampant poverty, political radicalism, and international aggression, and that would surely lead to catastrophic effects for the United States. Decades of experience have taught that American leadership is not a fool’s errand or a matter of altruism, but a pragmatic approach to advancing American security and wellbeing. There is little reason to think the situation has changed today. The fundamental lesson of the 1930s and 1940s—that no country is an island— remains as relevant as ever. If anything, as the world becomes increasingly interdependent, the security and prosperity of the United States are becoming ever more closely linked to the health of the larger international environment. And although the United States has many powerful allies, none of them can fill the singular role America has played in providing the international peace, stability, and prosperity in which the United States itself has flourished. U.S. leadership of a stable and open international environment remains as profoundly in the country’s own national interests as it was more than seven decades ago. Unfortunately, in recent years changes at home and abroad have eroded American military advantages and threatening U.S. interests. The Changing Strategic Environment After the Cold War, the United States faced a relatively benign security environment. There remained dangerous challenges to U.S. interests and—as shown by the terrorist attacks of September 11, 2001—the American homeland. Yet tensions between the world’s major powers were historically low, and the actors that threatened the United States, from so-called rogue states to jihadist terror organizations, were compar- atively weak. Today, however, the international landscape is more ominous. The United States confronts the most challenging security environment in decades. Six trends are particularly worthy of note. First, and most important, is the rise of major-power competition and conflict. The world America shaped has brought great security and prosperity to many countries. Yet today, powerful authoritarian rivals— China and Russia—see U.S. leadership as a barrier to their ambitions. These countries seek to overturn existing regional balances of power and re-create spheres of influence in which they can dominate their neighbors’ economic, diplomatic, and security choices. They are also seeking to project power and exert influence beyond their peripheries. They are pursuing their agendas, moreover, through the use of coercion, intimidation, and in some cases outright aggression, all backed by major military buildups that specifically target U.S. military advantages and alliance commitments and relationships. The challenge China presents is particularly daunting. It is natural for China to exert greater influence as its power grows, and the rise of China would present challenges for America and the world even if Beijing pursued its interests through entirely legitimate means. Unfortunately, China is increasingly exerting influence in illegitimate and destabilizing ways. China is using military, paramilitary, and diplomatic measures to coerce U.S. allies and partners from Japan to India; contest international law and freedom of navigation in crucial waterways such as the South China Sea; undermine the U.S. position in East and Southeast Asia; and other- wise seek a position of geopolitical dominance. It is using predatory economic statecraft to weaken its rivals, including the United States, and give it decisive strategic leverage over its neighbors. Meanwhile, China is reaping the fruits of a multi-decade military buildup. Beijing has invested in systems designed to counter American power-projection and thereby prevent the United States from protecting its allies, partners, and economic interests. China is also modernizing its nuclear forces, developing sophisticated power-projection capabilities, and undertaking the most thoroughgoing military reforms since the founding of the People’s Republic. China already presents a severe test of U.S. interests in the Indo-Pacific and beyond and is on a path to become, by mid-century, a military challenger the likes of which America has not encountered since the Cold War-era Soviet Union. Russia, too, is pursuing regional hegemony and global influence in destabilizing ways. Moscow has invaded and dismembered neighboring states, used cyberwarfare and other tactics to attack democratic nations’ political systems, and employed measures from military intimidation to information warfare to undermine and weaken NATO and the European Union. Russia has intervened militarily in Syria to bolster Bashar al-Assad’s brutal regime and restore lost influence in the Middle East, while supporting many other authoritarian governments. Across these in- itiatives, the Putin regime has demonstrated a propensity for risk-taking backed up by enhanced military power. Moscow has developed ad- vanced conventional capabilities meant to prevent America from project- ing power and aiding its allies along Russia’s periphery and to project its own power farther afield. Russia is also conducting a comprehensive nuclear modernization, including sustainment and modernization of a large number of non-strategic nuclear weapons and the development of a ground-launched cruise missile that violates the Intermediate-Range Nuclear Forces Treaty. These developments are accompanied by Russian doctrinal writings that emphasize the prospect of using limited nuclear escalation to control the trajectory of a potential conflict against the United States and NATO. Russia is seeking to create situations of military strength vis-à-vis America and its allies, and despite its limited resource base, it is having considerable success. Second, aggressive regional challengers—notably North Korea and Iran—are expanding their military capabilities consistent with their geopolitical ambitions. The United States and its allies have faced threats from a brutal, erratic, and aggressive North Korea for decades, but never before has Pyongyang possessed such destructive power. North Korea may already have the capability to detonate a nuclear weapon over a major American city; the regime also continues to develop biological, chemical, and conventional capabilities as a way of guaranteeing its sur- vival and coercing adversaries. Today, Kim Jong Un’s military can threaten America more directly than his father or grandfather. He can also exert great pressure on U.S. alliances with South Korea and Japan, sowing doubt about whether America would defend those allies in a cri- sis. This Commission hopes that ongoing negotiations will lead to the complete, verifiable, and irreversible denuclearization of North Korea, but the history of U.S.-North Korean negotiations give little cause for optimism. Even successful negotiations would leave America facing sig- nificant security challenges on the Korean Peninsula and in East Asia, most significantly the robust ballistic missile threat posed to our allies, Japan and the Republic of Korea. The threat from Iran, another longtime U.S. adversary and the world’s foremost state sponsor of terrorism, has also worsened. Iran has skillfully utilized asymmetric tactics including terrorism, the weaponization of sectarianism, support for insurgent groups, and a reliance on proxy and special operations forces to weaken U.S. influence and pursue hegemony in the Middle East. Iranian military capabilities are growing in areas such as unmanned aerial vehicles and explosive boats, advanced naval mines and submarines, more sophisticated cyber forces, and anti-ship and land- attack cruise missiles. Iran is also expanding what is already the largest ballistic missile force in the region. In a conflict with the United States, Iran could use these capabilities to obstruct freedom of navigation in regional waterways, target U.S. military facilities and critical infrastructure in the Persian Gulf, and otherwise inflict substantial costs on America and its partners. The challenges of major power conflict and aggressive regional challengers are linked by a third, which is the growing prevalence of aggression and conflict in the gray zone—the space between war and peace. The means of gray-zone conflict include everything from strong-arm diplomacy and economic coercion, to media manipulation and cyber- attacks, to use of paramilitaries and proxy forces. Singly or in combination, such tactics confound or gradually weaken an adversary’s positions or resolve without provoking a military response. Gray-zone conflict is often shrouded in deception or misinformation, making attribution diffi-ult and discouraging a strong response. Although coercive challenges of this sort are not new, they have become the tool of choice for those who do not wish to confront U.S. military power directly. China’s island-building and maritime coercion in the South China Sea, Iran’s sponsorship of Hezbollah and other militias as tools of influence and subversion in the Middle East, Russia’s use of unacknowledged military and proxy forces in Ukraine, and Moscow’s information warfare campaigns meant to inflame social tensions and in- fluence political processes in the United States and Europe all represent examples of gray-zone aggression today. Because gray-zone challenges combine military and paramilitary measures with economic statecraft, political warfare, information operations, and other tools, they often occur in the “seams” between DOD and other U.S. departments and agencies, making them all the more difficult to address. Fourth, the threat from radical jihadist groups has evolved and intensified. Groups such as ISIS, al-Qaeda, and their affiliates pose ongoing threats to the United States and its allies and partners, from Western Africa to the Philippines. That threat is not new, but it is expanding. There are more jihadists in more countries today than at any time since the birth of the modern jihadist movement in 1979, and there are more groups capable of mounting major attacks. The most sophisticated groups have developed state-like military capabilities, conquered (how- ever briefly) large swaths of territory, shown continued interest in acquiring weapons of mass destruction, and commanded or inspired deadly attacks around the globe. Assisted by poor governance, sectarian con- flict, and regional instability, these groups—or their successors—will threaten U.S. and international security for generations to come. Fifth, and compounding these challenges, the proliferation of advanced technology is eroding U.S. advantages and creating new vulnerabilities. The spread of weapons of mass destruction, ballistic and cruise missiles, precision-strike assets, advanced air defenses, antisatellite and cyberwarfare capabilities, and unmanned systems has given weaker actors the ability to threaten America and its allies in more dangerous ways. In some cases, we are behind, or falling behind, in critical technologies. U.S. competitors are making enormous investments in hypersonic delivery vehicles, artificial intelligence (AI), and other advanced technol- ogies. With respect to hypersonics in particular, the United States finds itself trailing China and perhaps Russia as well. All this raises the possi- bility that America may find itself at a technological disadvantage in future conflicts. Because the American way of war has long relied on technological supremacy, this could have profoundly negative implica- tions for U.S. military effectiveness. The United States thus confronts more numerous—and more severe— threats than at any time in decades. America must address the threats posed by major-power rivals, dangerous regional challengers, and terrorists simultaneously; it must deal with geopolitical conflict, gray-zone aggression, and instability from one end of Eurasia to the other. It must also prepare for the prospect that the U.S. military might be called into action in a country, region, or contingency that is not currently envisioned. The dangers posed by these and other troubling trends have been compounded by a final problem, of America’s own making: budgetary insta- bility and disinvestment in defense. Because of decisions made by both major parties—especially the enactment of the Budget Control Act (BCA) of 2011—constant-dollar defense spending (in estimated 2018 dollars) fell from $794 billion in Fiscal Year (FY) 2010 to $586 billion in FY2015, according to U.S. government statistics. In percentage terms, this constituted the fastest drawdown since the years following the Korean War. Excluding overseas contingency operations accounts— funding for wars in Iraq and Afghanistan—the inflation-adjusted decline was from $612 billion to $541 billion. This defense austerity was exacer- bated by political gridlock, which forced the Pentagon to operate on short-term continuing resolutions, and which triggered the crippling, across-the-board cuts associated with the sequester mechanism in 2013. The effects of these resource challenges have been devastating. By 2017, all of the military services were at or near post-World War II lows in terms of end-strength, and all were confronting severe readiness crises and enormous deferred modernization costs (see Figure 1). A series of temporary budget increases provided for by the Bipartisan Budget Acts of 2013, 2015, and 2018 provided welcome but insufficient relief. As the world has become more threatening, America has weakened its own defense. The Crisis of American Military Power and Its Consequences Collectively, these trends add up to a perilous situation. In 2010, the Quadrennial Defense Review Independent Panel warned of a coming “train wreck” if America did not retain adequate military capabilities in an increasingly competitive world. In 2014, the National Defense Panel warned that the U.S. military had become “inadequate given the future strategic and operational environment.” In 2018, this Commission believes that America has reached the point of a full-blown national security crisis. The U.S. military remains the strongest in the world, but the number and geographic diversity of security challenges, the technical so- phistication of U.S. rivals and adversaries, and other factors mean that America’s military capabilities are insufficient to address the growing dangers the country faces. America is courting unacceptable risk to its own national security, and to the stability and prosperity of the global en- vironment from which it has benefitted so much. Across multiple regions, adverse military trends and gray-zone aggres- sion are undermining U.S. influence and damaging U.S. interests. In the Western Pacific, the regional military balance has shifted dramatically because of China’s ongoing buildup and coercive activities. In Eastern Europe, Russian military modernization has left U.S. and NATO forces with severe vulnerabilities on the alliance’s eastern frontier. In the Mid- dle East, Tehran’s arsenal of asymmetric and anti-access/area denial ca- pabilities, along with its network of proxy forces, can create significant challenges for U.S. forces and influence, as Russia’s renewed regional military presence further inhibits American freedom of action. Looking beyond these regions, U.S. competitors and adversaries—particularly Russia and China—are increasingly contesting American control of the maritime, space, and cyber commons and improving their ability to strike the U.S. homeland (see Figure 2). The consequences of these shifts are profound. Because the military balance casts its shadow over international diplomacy, the erosion of U.S. military advantage is weakening the norms and principles for which America has traditionally stood. It is no coincidence that threats to freedom of navigation in the South China Sea—through which one-third of global shipping transits—have increased as the military balance has dete- riorated. Similarly, the credibility of American alliances—the bedrock of geopolitical stability in key areas—will be weakened as allies question whether the United States can defend them; American rivals and adversaries will be emboldened to push harder. From the Taiwan Strait to the Baltic region, peace and deterrence have long rested on the perception that the United States can decisively defeat military challenges. As that perception fades, deterrence weakens and war becomes more likely. Should war occur, American forces will face harder fights and greater losses than at any time in decades. It is worth recalling that during the Falklands War, a decidedly inferior opponent—Argentina—crippled and sank a major British warship by striking it with a single guided missile. The amount of destruction a major state adversary could inflict on U.S. forces today might be orders of magnitude higher. A war on the Korean Peninsula, for instance, would expose U.S. and allied citizens and forces in the region to intense conventional warfare and likely chemical and biological warfare. There would be a real possibility of North Korean nuclear strikes against allied countries in Northeast Asia and perhaps even against U.S. territory. If the United States had to fight Russia in a Baltic contingency or China in a war over Taiwan (see Vignette 1), Americans could face a decisive military defeat. These two nations possess precision-strike capabilities, integrated air defenses, cruise and ballistic missiles, advanced cyberwarfare and anti-satellite capabilities, significant air and naval forces, and nuclear weapons—a suite of advanced capabilities heretofore possessed only by the United States. The U.S. military would face daunting challenges in establishing air superiority or sea control and retaking territory lost early in a conflict. Against an enemy equipped with ad- vanced anti-access/area denial capabilities, attrition of U.S. capital assets—ships, planes, tanks—could be enormous. The prolonged, delib- erate buildup of overwhelming force in theater that has traditionally been the hallmark of American expeditionary warfare would be vastly more difficult and costly, if it were possible at all. Put bluntly, the U.S. military could lose the next state-versus-state war it fights.

## Case

### advantage

#### Status quo efforts can solve Kessler syndrome – their impact is overhyped and at best non-unique. Prefer our card’s probability analysis report and empirical examples

Lewis 15 [Hugh Lewis, Senior Lecturer in Aerospace Engineering. “Space debris, Kessler Syndrome, and the unreasonable expectation of certainty.” Room Space Journal of Asgardia. 2015. <https://room.eu.com/article/Space_debris_Kessler_Syndrome_and_the_unreasonable_expectation_of_certainty>] HW AL

There is now widespread awareness of the space debris problem amongst policymakers, scientists, engineers and the public. Thanks to pivotal work by J.C. Liou and Nicholas Johnson in 2006 we now understand that the continued growth of the debris population is likely in the future even if all launch activity is halted. The reason for this sustained growth, and for the concern of many satellite operators who are forced to act to protect their assets, are collisions that are expected to occur between objects – satellites and rocket stages – already in orbit. In spite of several commentators warning that these collisions are just the start of a collision cascade that will render access to low Earth orbit all but impossible – a process commonly referred to as the ‘Kessler Syndrome’ after the debris scientist Donald Kessler – the reality is not likely to be on the scale of these predictions or the events depicted in the film Gravity. Indeed, results presented by the Inter-Agency Space Debris Coordination Committee (IADC) at the Sixth European Conference on Space Debris show an expected increase in the debris population of only 30% after 200 years with continued launch activity. **Collisions are still predicted to occur, but this is far from the catastrophic scenario feared by some.** Constraining the population increase to a modest level can be achieved, the IADC suggested, through widespread and good compliance with existing space debris mitigation guidelines, especially those relating to passivation (whereby all sources of stored energy on a satellite are depleted at the end of its mission) and post-mission disposal, such as de-orbiting the satellite or re-orbiting it to a graveyard orbit. Nevertheless, the anticipated growth of the debris population in spite of these robust efforts merits the investigation of additional measures to address the debris threat, according to the IADC. On the face of it, there appears to be considerable procrastination or, worse, apathy towards the development of guidelines for debris removal in spite of calls for action. But is this really the case? This probability tree shows the possible outcomes from drawing two cards from a pack of 52 regular playing cards. It can be used to illustrate the difficulties accociated with the choice of which piece of space junk to remove. No progress? In the nine years following the publication of the work by Liou and Johnson **there has been considerable interest shown in remediation of the space environment. In particular, significant effort has been invested across the globe in the development of methods to remove objects from low Earth orbit.** The European Space Agency, for example, recently announced its intention to seek ministerial approval for a mission to deorbit a European spacecraft in the next decade. The Agency has conducted numerous studies to investigate appropriate and reliable methods to achieve this. A key driver for these widespread efforts has come from the work conducted using computer codes – evolutionary models – of the debris environment, which suggest that the growth of the debris population can be prevented if particular spacecraft or rocket stages are removed. In the computer simulations, these objects are identified as the most likely to collide and so the consequence of their removal in reality should be a reduction in the number of collisions that will occur in the environment, which would curb the generation of new fragmentation debris. Given that is has been nearly a decade since the publication of the work by Liou and Johnson, it is surprising to some that no guidelines have yet been introduced at the international or national level, which detail the remediation measures that can be taken by government and industry. In fact, a recent announcement by NASA of a focus on technology development rather than in-flight demonstrations of debris removal technologies was greeted with some criticism. On the face of it, there appears to be considerable procrastination or, worse, apathy towards the development of plans or guidelines for debris removal in spite of calls for action. But is this really the case? The real issue comes from the seemingly simple task of identifying the correct debris to remove from orbit … In fact, the situation is not as simple as it might appear; there are some fundamental questions that remain to be answered about debris removal. Of particular concern are issues relating to ownership, liability and transparency. Many of the technologies that have been put forward for debris removal could also be used to remove or disable an active spacecraft, for example. Hence, it can be argued that these technologies could be used as weapons. There are also questions about the cost of a sustained programme of debris removal – some engineers put it at tens of trillions of dollars. However, perhaps the most important reason for the lack of relevant guidelines is that we don’t yet know how to accomplish remediation, by which we mean cleaning up space, in practice. That is not to say that we don’t know what technologies we might need. As mentioned above, there has been considerable effort already expended towards understanding these requirements and moving the necessary technology forwards. For one-off use, some technologies are very nearly ready. The real issue comes from the seemingly simple task of identifying the correct debris to remove from orbit. Until we can solve this problem, the likelihood is that debris remediation will not succeed, the debris population will continue to grow – seemingly out of our control – and the attempt will come at great cost. Without the reasonable expectation of success, it is virtually impossible to define appropriate and robust guidelines that can be used to direct remediation endeavours.

#### Non-state actors in space are conflict dampeners – they avoid geopolitical tension and have financial incentives to keep conflict low – this turns case

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In the terms of privatization and space security, space remains relatively untapped, but commercial and military benefits from space exploration/exploitation could even lead to ‘privatization of space’. Such privatization will result from growing pressure on spacefaring countries to defect from cooperation, since is less viable with good number of multiple actors who entered the space.36 However, space policy and space research are characterized by very high costs, which are rather impossible to bear by private companies, limited by economic calculation. As pointed out earlier, under-investment in technological development by private companies it is related to the fact that these actors are not focused on profits of a social nature, such as improving the quality of life of the recipient of the product.37 This makes some technology, potentially beneficial to society, not developed or introduced into use, because the profit margin is too small to make this viable for commercial players. To conclude, privatization of space security can develop in unexpected ways, but in today’s space environment private actors would rather play the role of security regulators than security providers. When investment in space technologies is less profitable than other areas of economy, private actors would focus on soft law and conflict prevention in space, and new private initiatives will appear. For example, apart from important space companies, as SpaceX or Blue Origin active in outer space, other private actors as Secure World Foundation (SWF), who focus on space sustainability, will play more important role in crafting international guidelines for space activities.38 This path the way for future solutions and projects, as cleaning the space debris, extracting resources from asteroids and planetoids, refuelling satellites, providing payload capabilities for governmental entities on market-based logic, will be based on activity non-state actors, providing soft law and regulatory solutions, where space faring states are unable to find any compromise. Therefore private companies will be in fact global (or space) regulators, as part of UNCOPUS, being involved in space activities.39 The last argument for private involvement in space security comes from an approach based on common good and resilience of space assets, emphasized by the Project Ploughshares, as an important part of space security. As of 2017 there are more than 700,000 man-made objects on the Earth’s orbit bigger than 1 cm, while 17,000 of them are bigger than 10 cm.40 Some of them are traced by SSA systems, both American and European, but these systems are public-military owned, and private operators are not granted any access to this data. Any collision of space object with space debris, even with small particles, might result in a chain reaction, called Kessler’s syndrome, and not only private but public, and military assets will be destroyed or impaired. In such conditions, a reluctant cooperation between the public and private sector, and unwillingness to share vulnerable data by public actors seem to confirm that private space activity is more than necessary. This is an apparent case when logic of mistrust between state powers must be overcome by private actors, perhaps by suggesting common preferences for debris mitigation, and space situational awareness. In the case of space debris, Space Data Association, an initiative supported by private sector, with its main aim to enhance data sharing between commercial satellite operators, could be an example of nascent public good provided by private actors for the sake of global security.

### solvency

#### Public trust doctrine is a terrible method – outdated, unenforceable, forecloses other effective action

Lazarus JD 86

Richard J Lazarus (harvard law professor witta law degree from harvard), 1986 " Changing Conceptions of Property and Sovereignty in Natural Resources: Questioning the Public Trust Doctrine," Iowa Law Review, https://www.repository.law.indiana.edu/cgi/viewcontent.cgi?article=3055&amp;context=facpub, // HW AW

Over the last fifteen years, the public trust doctrine has been the object of a remarkable revival in natural resources law. At the time of its "Renaissance" it served to highlight important societal values not then in focus. Accelerating changes in the law suggest that it is now time to bring that revival to a close-to lift the public trust doctrine "patch" from the emerging fabric of modern natural resources law. Operation of the doctrine inevitably depends on the judicial application of labels that obscure the true factors behind the judicial decision. Moreover, those **legal categories upon which the doctrine inexorably relies may have been meaningful once, but they have become arbitrary and wooden with age.** Natural resources law has for too long been inflicted with a host of such false legal categorizations, **inhibiting its developments in times of new information and changing social values**. Indeed, the recent history of natural resources law is most prominently marked by a continuous struggle to be freed of historical shackles so that natural resources law can properly be fused with and into modern notions of tort and property law. Simply put, **the public trust doctrine, even if aimed at promoting needed resource conservation and environmental protection goals, is a step in the wrong direction.** The doctrine amounts to a romantic step 476. The historical underpinnings upon which the public trust doctrine is based, especially Roman law, have in recent years come under sharp attack by commentators, thus further weakening the long-term viability of the doctrine. See supra note 10. 477. L. FULLER, supra note 164, at viii. 71 IOWA LAWREVIEW 631 [19861 backward toward a bygone era at a time when we face modern problems that demand candid and honest debate on the merits, including consideration of current social values and the latest scientific information. The complex and pressing resource allocation and environmental protection issues we currently face will continue to tax severely the most concerted societal efforts and the best legal and scientific minds. Dramatic shifts in legal rules, primarily in traditional notions of private property, will continue to be necessary, challenging the patience and understanding of the public, to whom the law must ultimately justify its legitimacy. Although perhaps unfortunate, short of a major redirection of this nation's social and economic infrastructure, 478 little, if any, room is left in these tasks ahead for the mythopoeism of the public trust doctrine.

#### Don’t give them total solvency on their coop scenario – half of the things Manning says are killing coop are public

1AC Manning 21

In the real world, the treaty is sadly outdated by both technology (as ASAT tests demonstrate) and geopolitics, as the U.S., Russia and China plan Moon bases and private sector firms plan to exploit minerals on asteroids, for starters. In this era of populist nationalism and major powers competing for dominance, fashioning new regimes or codes of conduct for space appears highly problematic.

### One more kessler card if time

#### Kessler syndrome is media hype – no risk

Von Fange 17

Daniel von Fange (systems engineer. Fond of charts), 5-21-2017, "Kessler Syndrome is Over Hyped," braino, http://braino.org/essays/kessler\_syndrome\_is\_over\_hyped/, // HW AW

Kessler Syndrome is overhyped. A chorus of online commenters greet any news of upcoming low earth orbit satellites with worry that humanity will to lose access to space. I now think they are wrong. What is Kessler Syndrome? Here’s the popular view on Kessler Syndrome. Every once in a while, a piece of junk in space hits a satellite. This single impact destroys the satellite, and breaks off several thousand additional pieces. These new pieces now fly around space looking for other satellites to hit, and so exponentially multiply themselves over time, like a nuclear reaction, until a sphere of man-made debris surrounds the earth, and humanity no longer has access to space nor the benefits of satellites. It is a dark picture. Is Kessler Syndrome likely to happen? I had to stop everything and spend an afternoon doing back-of-the-napkin math to know how big the threat is. To estimate, we need to know where the stuff in space is, how much mass is there, and how long it would take to deorbit. The orbital area around earth can be broken down into four regions. Low LEO - Up to about 400km. Things that orbit here burn up in the earth’s atmosphere quickly - between a few months to two years. The space station operates at the high end of this range. It loses about a kilometer of altitude a month and if not pushed higher every few months, would soon burn up. For all practical purposes, Low LEO doesn’t matter for Kessler Syndrome. If Low LEO was ever full of space junk, we’d just wait a year and a half, and the problem would be over. High LEO - 400km to 2000km. This where most heavy satellites and most space junk orbits. The air is thin enough here that satellites only go down slowly, and they have a much farther distance to fall. It can take 50 years for stuff here to get down. This is where Kessler Syndrome could be an issue. Mid Orbit - GPS satellites and other navigation satellites travel here in lonely, long lives. The volume of space is so huge, and the number of satellites so few, that we don’t need to worry about Kessler here. GEO - If you put a satellite far enough out from earth, the speed that the satellite travels around the earth will match the speed of the surface of the earth rotating under it. From the ground, the satellite will appear to hang motionless. Usually the geostationary orbit is used by big weather satellites and big TV broadcasting satellites. (This apparent motionlessness is why satellite TV dishes can be mounted pointing in a fixed direction. You can find approximate south just by looking around at the dishes in your northern hemisphere neighborhood.) For Kessler purposes, GEO orbit is roughly a ring 384,400 km around. However, all the satellites here are moving the same direction at the same speed - debris doesn’t get free velocity from the speed of the satellites. Also, it’s quite expensive to get a satellite here, and so there aren’t many, only about one satellite per 1000km of the ring. Kessler is not a problem here. How bad could Kessler Syndrome in High LEO be? Let’s imagine a worst case scenario. **An evil alien intelligence chops up everything in High LEO, turning it into 1cm cubes of death orbiting at 1000km, spread as evenly across the surface of this sphere as orbital mechanics would allow. Is humanity cut off from space? I’m guessing the world has launched about 10,000 tons of satellites total.** For guessing purposes, I’ll assume 2,500 tons of satellites and junk currently in High LEO. If satellites are made of aluminum, with a density of 2.70 g/cm3, then that’s 839,985,870 1cm cubes. A sphere for an orbit of 1,000km has a surface area of 682,752,000 square KM. So there would be one cube of junk per .81 square KM. If a rocket traveled through that, **its odds of hitting that cube are tiny - less than 1 in 10,000**. **So even in the worst case, we don’t lose access to space.** Now though you can travel through the debris, you couldn’t keep a satellite alive for long in this orbit of death. Kessler Syndrome at its worst just prevents us from putting satellites in certain orbits. In real life, there’s a lot of factors that make Kessler syndrome even less of a problem than our worst case though experiment. Debris would be spread over a volume of space, not a single orbital surface, making collisions orders of magnitudes less likely. Most impact debris will have a slower orbital velocity than either of its original pieces - this makes it deorbit much sooner. Any collision will create large and small objects. **Small objects are much more affected by atmospheric drag and deorbit faster**, even in a few months from high LEO. Larger objects can be tracked by earth based radar and avoided. The planned big new constellations are not in High LEO, but in Low LEO for faster communications with the earth. They aren’t an issue for Kessler. Most importantly, all new satellite launches since the 1990’s are required to include a plan to get rid of the satellite at the end of its useful life (usually by deorbiting) So the realistic worst case is that insurance premiums on satellites go up a bit. Given the current trend toward much smaller, cheaper micro satellites, this wouldn’t even have a huge effect. **I’m removing Kessler Syndrome from my list of things to worry about.**