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#### **Counterplan: The appropriation of resources from asteroids constrained by “beneficial use” in outer space by private entities is just.**

#### **“Beneficial use” solves every deficit AND provides incentives- appropriation is key**

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[Ross, "The doctrine of appropriation and asteroid mining: Incentivizing the private exploration and development of outer space", Oregon Review of International Law 17, 2015, 183-204, accessed 1-9-22]

THE CURRENT INTERNATIONAL TREATIES THAT REGULATE THE OWNERSHIP OF ASTEROIDS *FAIL TO INCENTIVIZE* THE DEVELOPMENT AND EXPLORATION OF OUTER SPACE

Currently, there are two outdated international treaties that attempt to adjudicate the use and exploration of space. The first treaty, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (1968), is an archaic but influential agreement ratified by nearly all of the world nations that have successfully launched a shuttle into space.47 The second treaty, The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (1979), was an attempt to reform some of the principles from the Outer Space Treaty that failed to garner popular acceptance because it was not signed by any nations with national space programs.48 While both treaties attempt to deal with many issues, including the ownership of celestial bodies, both fail to allow for the ownership and development of asteroids by government or private entities. Because they were written during the space race in a period of international distrust, it makes sense that these treaties would be concerned with tempering the race to establish sovereign control over celestial bodies. However, as space exploration shifts from being financed and controlled by national governments to being financed by private industry, these concerns may be less important.49

NASA (National Aeronautics and Space Administration), the U.S. space program, was once a well-funded program. It was the focus of the American people in 1961 when President John F. Kennedy announced before a joint session of Congress the ambitious goal of sending a man to the moon.50 The funding for NASA has dwindled in modern times, and the organization now gets around 0.5% of the federal budget, which is the lowest it has been since Kennedy’s 1961 speech.51

Despite a decrease in national space program funding, corporate space missions are on the rise. In 2010, President Obama proposed that NASA exit the business of flying astronauts from Earth to low Earth orbit and move it to private companies.52 Several companies have stepped up to bat, and corporate space programs now include space tourism, supply missions, and in one case a one-way colonization mission to Mars.53 Corporate interest in space tourism and development demonstrates a strong *private* commercial *interest* in space as an industry, which could serve to finance the exploration of space in a period where national governments do not have an active financial interest in space. However, under current international treaties, the ownership of asteroids is prohibited, preventing corporations willing to invest in asteroid mining from having a secure claim.

A. The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (1967) Prohibits Commercial Property Claims

The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (Outer Space Treaty of 1967), is currently the most influential source of international legislation regarding space law.54 Ratified in 1967 by most of the U.N. nations that had successfully launched a shuttle into space, the Outer Space Treaty of 1967 carries much more weight than the subsequent “Moon Treaty” of 1978.

The Outer Space Treaty of 1967 addresses many different issues, including the military development of space,55 the commission of aid to distressed astronauts,56 international liability for damage caused by space objects,57 and the guaranteed cooperation between state-actors in space.58 While the agreement does an admirable job dealing with many of these issues, it fails to grant any kind of ownership claims over celestial bodies.

Under the Outer Space Treaty of 1967, both government and private entities are prohibited from claiming ownership over celestial bodies. Article II of the agreement explicitly states that, “Outer space, including the Moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”59

While this statement seems reasonable for preventing a government from, say, claiming the moon, it makes no distinction between the moon and asteroids, planets, meteorites, comets, or other celestial bodies. By preventing the ownership of celestial bodies, even those that have no utility beyond the resources they contain, the treaty effectively destroys the financial gain that could motivate corporations to explore and develop space.

B. The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (1979) Also Fails to Recognize the Need to Provide Ownership Rights in Celestial Bodies

The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies of 1979 (The Moon Treaty) also fails to create property rights in celestial bodies in a way that would incentivize space travel.60 Widely considered a failure, the Moon Treaty was an attempt to reform the Outer Space Treaty of 1967, but it was not ratified by any nation that had successfully launched a shuttle into space.

The Moon Treaty took an idealistic approach to international space law, and if it were more effective it would have established an international regime to carry out its goals.61 The stated goals of the regime were to develop the natural resources of the moon and other celestial bodies, rationally manage those resources, and expand opportunities for parties to use and share the resources.62

While the creation of said regime never occurred, it is clear the drafters of the Moon Treaty clearly foresaw the need for international agreement regarding space resources. Among other things, the Moon Treaty prohibits state parties from developing a military presence on the moon or any other celestial body,63 or excluding other state parties from scientific investigation in space.64 The Moon Treaty also attempts to require that any scientific discoveries useful to mankind be shared with the Secretary-General of the United Nations as well as the public and the international scientific community.65 Unlike the Outer Space Treaty of 1967, the Moon Treaty calls for the U.N. to maintain control over space, and has numerous provisions that call for approval by the Secretary-General of the United Nations before a state party can act.

The Moon Treaty was an attempt to rationally manage space resources by creating an international regime to oversee space development. It fell short, however, by failing to grant substantive commercial rights that would incentivize space travel, making no distinction between planets, comets, asteroids, or space debris with respect to its provisions (like the Outer Space Treaty), and by applying its provisions exclusively to state parties with few references to private action.66

Article 11, paragraph 2 of The Moon Treaty states that “[t]he moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any means.”67 Thus, under the Moon Treaty, no entity can lay claim of ownership upon anything in space, regardless of the purpose of the claim. The agreement goes further to say explicitly that the surface, subsurface, and the natural resources in place on the moon will not become property of any state; international intergovernmental or nongovernmental organization; national organization or nongovernmental entity; or of any natural person.68 Put differently, the Moon Treaty explicitly prohibits both private and government actors from making commercial claims over the moon, and since the treaty is meant to apply to any celestial body within the solar system, it follows that the same rule applies to space resources like those found on asteroids. While protecting space resources for science is certainly a laudable goal, the Moon Treaty prevents commercial claims in space, effectively stonewalling space’s development. One can hardly imagine a corporation spending the tremendous amount of money necessary to launch a space mission if the only payoff would be the chance to do research that would ultimately have to be shared with the public, including the corporation’s competitors.

Like the Outer Space Treaty of 1968, the shortcomings of the Moon Treaty demonstrate the need for new international legislation regarding the right to own and use space resources like asteroids. The exploration and development of space could be incentivized and facilitated by a new international treaty that affords property rights to private and government entities in asteroids. The doctrine of appropriation would be a logical governing rule.

III THE APPLICATION OF THE DOCTRINE OF APPROPRIATION TO ASTEROID MINING WOULD INCENTIVIZE CORPORATE SPACE EXPLORATION WHILE PREVENTING WASTE AND ABSTRACT CLAIMS

Like water during the expansion of the American West, the exploration of space can be financed and *incentivized* by *granting rights in resources* to those who secure new resources and put them to *beneficial use*. Some legal scholars have suggested the traditional rule of capture be applied to asteroids,69 or that rights to asteroids be purchased directly from an international agency and owned as chattel.70 However, like water during America’s westward expansion, asteroids are not easily classified under traditional property regimes. Thus, a doctrine of appropriation would be more appropriate for asteroids than a traditional rule of capture or a chattel system, because a system based on the traditional *rule of capture* or chattel would result in *waste*, *abstract claims*, and *complicated legal issues*.

First, asteroid claims cannot be adjudicated under the traditional rule of capture, or as chattel, because such systems would be incredibly wasteful. As of now, scientists have observed approximately 450,000 asteroids in our solar system.71

But only a fraction of the observable bodies will be cost effective to mine. While it might one day be possible for a single entity to finance several mining missions at once, current costs associated with such a venture would limit almost any space-mining program to one or two asteroids, at least initially.72 The traditional rule of capture could allow an entity to quickly claim multiple asteroids merely by landing on them and planting a flag, without requiring the entity to show it can reasonably use the resources they have claimed. Even worse would be a system where the same corporation could claim asteroids simply by discovering their existence and registering the claim. Allowing this type of unregulated claim would incentivize larger corporations capable of space travel to quickly claim reachable asteroids, but the claims could easily outpace those entities’ realistic expectations on what they could use. Under a traditional rule of capture system, the solar system could be divvied up long before the resources could conceivably be mined. A rule similar to the doctrine of appropriation used for water claims in the United States would alleviate this concern by limiting claims to those where a claimant can show a reasonable beneficial use for the resource.

Another concern posed by the traditional rule of capture or chattel system would be the creation of abstract claims. Some legal scholars have advocated for a system where asteroids would be categorized as chattel, and rights in asteroids would be granted to an entity that could identify an asteroid and register ownership of it with an international agency.73 The advantage of such a system would be that it would allow an international agency to keep track of asteroids, and it would allow for the mapping of the reachable solar system. The problem with this approach, however, is that it would result in abstract claims. If an entity could claim the rights to an asteroid without actual possession, there is nothing to prevent that company from claiming ownership long in advance of any real possibility of landing on it. One of the reasons for creating the doctrine of appropriation was to limit abstract claims over resources that were not being used in any reasonable way. Just as the plaintiffs in Hague had no recourse against the third party who wasted the natural gas reserve, there would be no cause of action against an entity that has the rights to an asteroid, but chooses not to exercise them.74 This may be particularly harmful to society because asteroids contain volatiles that may be essential to creating rocket fuel in space, which, in turn, may be crucial to deep space exploration.

Using asteroid-bound volatiles to make rocket fuel would reduce the cost and increase the range of space exploratory missions, possibly improving the human race’s ability to explore and develop space. Under a system were entities could claim asteroids without actual possession, those entities could exclude others from landing on the asteroids and using such resources, even when such resources are languishing unused in space. To prevent the creation of such abstract claims over asteroids, the doctrine of appropriation could be modified as to only grant rights only to entities who are able to demonstrate both actual possession and beneficial use. This would ensure that asteroids claims are limited to those where the resources are actually being used, thus, maximizing the utility of such celestial bodies to society.

Finally, asteroids cannot be adjudicated under the traditional rule of capture or a chattel system because their unique propensity to collide with other celestial bodies would result in vexing legal issues. Pop culture has popularized the notion of an asteroid crashing into the surface of Earth in movies and books, but interspace collisions may be a real concern. Asteroids are constantly moving through space, and they often crash into other asteroids or space debris, and sometimes onto the surface of planets. So real is the concern that space agencies regularly keep track of NEOs, or Near Earth Objects, which include around 10,000 asteroids large enough to be tracked in space.75 Imagine the scenario in the popular movie Armageddon, where society wrestles with the mechanics of destroying a huge asteroid that is headed straight for Earth.76 It would be strange, indeed, if the situation were further complicated by an entity owning the asteroid. Would the Earth have to compensate the company for the loss of resources, or would the company be forced to assume liability for the damage caused by the collision? What if the asteroid, rather than crashing into Earth, crashed instead into another asteroid owned by different entity? It makes sense that a company with actual possession of an asteroid should have a claim for actual mining equipment destroyed, but it seems unreasonable to treat the entire rock as the entity’s chattel. By limiting asteroid claims under a doctrine of appropriation-like system, society will be saved the headache of attempting to adjudicate such absurd situations.

Because the traditional rule of capture or a chattel system for the ownership of asteroids would result in waste, abstract claims, and absurd legal dilemmas, a modified doctrine of appropriation should replace existing outdated international space law relating to asteroids.

CONCLUSION

The doctrine of appropriation is a *reasonable rule for adjudicating asteroid claims*, and it could easily be modified to apply to asteroid mining. In the context of water rights, the doctrine of appropriation requires that the claimant be a landowner in order to claim the right to use a water source. It does not make sense, however, for the international community to grant complete ownership over asteroids toa single entity, so the landowner requirement of the rule should be removed. A similar modification would need to be made to the "beneficial use" language of the doctrine.

In the context of water rights, an appropriator obtains rights only to water that he or she can reasonably put to beneficial use. The metals contained in asteroids have a high level of *marketability*. For that reason, a mining entity could potentially put any amount of obtained metal to beneficial use, in the sense that the resources can be sold. This, however, would defeat the purpose of the rule, which is to limit such unreasonable claims. To ameliorate this problem, the doctrine of appropriation could be modified to define "*beneficial use* "constructively by providing that beneficial use is assumed for any resources that have been removed from the asteroid that the mining entity can reasonably hope to transport to market in a return journey. With the astronomical cost of undertaking a trip to such an asteroid, this modification would *limit* mining entities to only what they can carry back, thereby leaving the *untapped resources available* to other entities capable of making the same trip. Considering the size and profitability of metal deposits on asteroids, this modification to the doctrine of appropriation would *not be overly burdensome* to corporate interests. At the same time, it would satisfy the economic imperative of *promoting the rapid development of asteroid resources*.

By changing the landowner requirement, and qualifying the “beneficial use" language, the doctrine of appropriation would be essentially ready for application to asteroid mining claims. The only other changes necessary would be some additional requirements that are common to other space related provisions, like those found in the Outer Space Treaty of 1968. For example, a reporting requirement or clause guaranteeing asylum for other astronauts. A functional rule might read something like this:

State parties or private entities may, upon actual possession, lay claim to natural resources found on or below the surface of asteroids. Rights to appropriate are given in order of seniority, starting with the first party to land on the surface of the asteroid and establish control over the resources, be it water, methane, metal, or any other beneficial substances. A party will be said to have established control over a resource once he has mined the substance and removed it from the asteroid. A senior appropriator may use as much of the asteroid's resources as he can take from the asteroid and put to beneficial use, and may continue to enlarge his share until another junior appropriator begins to appropriate resources from source for beneficial use. For the purposes of this Agreement, "beneficial use “refers to the amount of resources that an appropriator has removed from the asteroid that the actor may reasonably hope to bring home in a return voyage. Resources in excess of what an appropriator can reasonably hope to transport to market in a single voyage do not qualify as having a beneficial use, and are therefore not yet claimed. This means that the extraction of metal from an asteroid does not serve to provide ownership if the appropriator plans on letting the resources languish until another voyage is undertaken to secure the resources and bring them back to Earth. Junior appropriators receive rights in the source of resources (the asteroid) as they find it, and may prevent the senior appropriator from enlarging his share to the junior appropriator’s detriment under a no-injury rule. No state party will attempt to hinder other parties from landing on or using the asteroid, and parties will assist other entities on an asteroid, should they need emergency assistance. Mining claims on asteroids will be reported to the Secretary-General of the United Nations, and state parties agree to release the location of the asteroid, and any scientific findings to the United Nations, the general public, and the scientific community. In the event that the asteroid is on a collision course with any other celestial body, all state parties agree to follow the course of action suggested by the United Nations. Should the United Nations decide the asteroid must be destroyed, no state party may claim liability for resources contained within the asteroid, but not yet captured. This provision applies only to asteroids as classified by the scientific community, and does not apply to planets, comets, meteorites, or any other celestial body not mentioned.

There is no doubt that asteroids may be *extremely beneficial* to mankind, both as a source of resources and as a jumping-off point to far off locations in space. The human-race has progressed scientifically and technologically to the point that space travel is *within commercial reach*, and the need for new international laws governing the ownership of space has never been more apparent. The Outer Space Treaty of 1968 made great strides in developing rational rules for space and many of its provisions should be maintained in their original form. However, by allowing ownership of asteroids under the doctrine of appropriation, the international community can *incentivize* the exploration and *development* of space in a way that reflects the needs of society in general, *without vesting an absolute monopoly* in a single entity. The doctrine of appropriation helped drive American westward expansion, and its application to space mining would help drive the human race in its expansion into the space, the final frontier.

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

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

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

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

NC – Innovation DA

Innovation DA

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

**Weinzierl and Elbling 2021**

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

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

#### **Innovation solves every existential threat**

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

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

Satellites DA

Satellites DA

#### **Private company focus on satellites key for improved internet connection**

**Russon 21** – Technology of Business Reporter, BBC News

[Mary-Ann Russon, “Satellite boom attracts technology giants,” BBC News, 1-29-21, <https://www.bbc.com/news/business-55807150>]

**Sir Richard Branson's rocket company Virgin Orbit has joined a growing list of private companies that can launch satellites into orbit.** Earlier this month, [**10 payloads were lofted**](https://www.bbc.co.uk/news/science-environment-55699262) on the Virgin Orbit rocket, which was launched from under the wing of one of the entrepreneur's old 747 jumbos. Sir Richard is hoping to tap into what is a growing market for small, lower-cost satellites. Space has traditionally had a high barrier to entry. Today, just seven firms make up 75% of the industry, according to Scott Campbell, director at Deloitte Ventures. The space industry is worth $380bn (£285bn), and 60% of that is commercial. But previously, virtually all investment into space was by governments, he says. The first real shift came in 2011 when US President Barack Obama opened up space to businesses, and now more disruption is coming. "The new space race and start-up scene is almost entirely based around space applications: what can I do with data from space?" says Mr Campbell. Traditionally, building and launching a satellite to collect data or enable communications costs hundreds of millions of dollars. The satellites weighed up to six tonnes, were the size of a bus, and would be sent up into geostationary orbit - 35,786km (22,236 miles) above the Earth. But today, you could send up a so-called nanosat weighing just 25-50kg into low-Earth orbit (160-1,000km above Earth) for between $100,000 and $1m. Launch prices are also falling because technology giants are driving demand, says Mark Boggett, chief executive of British venture capital firm Seraphim Capital. "Because tech firms need to launch their own satellites in the thousands [for space internet networks], this further drives down the cost of launch and storage for everyone else," he says. "Whole new industries of businesses can benefit from using this data, essentially democratising space." And of course, if more data is being transmitted back to Earth, someone will need to process it. As a result, Deloitte's Scott Campbell has seen "an explosion of businesses around space". In 2011, there were 234 space-related firms in the UK, rising to 948 companies in 2018. As for satellites, today there are fewer than 9,000 in orbit, according to Seraphim. OneWeb, SpaceX, Planet, Spire and Amazon have put up 10% of these satellites since 2016, but there are 200 smaller firms behind them who are projected to launch 25,000 satellites over the next four years. One smaller firm is nanosat manufacturer NanoAvionics, which announced plans in October to create 400 new jobs in the UK. The firm saw revenues soar 300% in the last year. "In the old days, we launched one satellite that had lots of sensors on it. But today, we've launched hundreds of satellites that have the same one sensor, and that's a much cheaper, repeatable way to do it with more consistent data," says Robin Sampson, head of operations at NanoAvionics UK. PWC UK's space lead Dinesh Patel says the nanosat market is worth only £1.8bn today, but annual growth rates of 20% are projected. Satellites have traditionally been used for communications, TV services and tracking the weather, but new cheaper options are attracting tech giants with **big plans**. Late last year Microsoft announced it was teaming up with Elon Musk's SpaceX. Their partnership, Azure Space, [**plans to combine**](https://news.microsoft.com/transform/azure-space-partners-bring-deep-expertise-to-new-venture/#:~:text=our%20partners%20below.-,SpaceX,via%20SpaceX's%20Starlink%20satellite%20network.) Microsoft's cloud computing services with a global network of satellites. Tom Keane, corporate vice president at Microsoft Azure, tells the BBC that space makes it possible to "move computing to the edge", which means processing data much closer to users' devices than ever before. "The edge could be anywhere - on a device... you're wearing, it could be something you're carrying, it could be in your car," he says. "Space allows you to connect all of that infrastructure together, and then you can use artificial intelligence [like] predictive analytics to gain insights over things that were previously not connected together." Ground stations, which receive data from satellites, are also potential money makers for IT giants. Microsoft Azure's Tom Keane plans to revolutionise ground stations, which are currently "expensive and often monolithic devices" and hook them up to Microsoft's data centres. "Today, in many cases, data [from ground stations] may not be used, or it's certainly not used as broadly as it could be. By connecting that ground station, you take the data from space... to solve problems that you can't solve today." Another opportunity is to connect the **3.8 billion people** in rural areas who **still** do not have an internet connection. SpaceX in particular [**has been launching batches of small satellites**](https://www.bbc.co.uk/news/science-environment-55775977) into orbit since 2018 to form a huge constellation, with the aim of providing **instant broadband anywhere on Earth**. Other businesses will hope to make money by collecting data from nanosats, processing it with artificial intelligence, and using it in innovative ways to solve problems. Firms are looking to collect Earth observation data like weather, heat signatures and atmospheric gas composition to help farmers, for example, and to monitor things like flood defences, traffic and construction sites.

#### **Better connection required for telehealth – access suffers without it**

**Balasubramanian 20** – M.D, J.D

[ Sai Balasubramanian, “Elon Musk’s Starlink May Potentially Revolutionize Healthcare,” Forbes, 11-27-2020, <https://www.forbes.com/sites/saibala/2020/11/27/elon-musks-starlink-may-potentially-revolutionize-healthcare/?sh=37c89b241e03>]

One of Elon Musk’s relatively recent and most successful ventures is [SpaceX](https://www.spacex.com/mission/), an advanced aerospace technology company with a mission of “Making Humanity Multiplanetary.” The company has celebrated some incredible milestones thus far, from its successful transportation of astronauts into space, to its valiant strides in making rocket technology reusable, and therefore, more cost-efficient. One interesting sub-division of SpaceX is Starlink, which is Musk’s venture into increasing global connectivity. Starlink’s [mission](https://www.starlink.com/) is to use a global network of low Earth orbit satellites to eventually “deliver high speed broadband internet to locations where access has been unreliable, expensive, or completely unavailable.” While satellite internet itself is not a novel concept, most of the traditional systems use **dated technology** that have far less capabilities with regards to internet speed, connectivity, and sustainability. Starlink’s goal is to provide high-speed broadband internet, using cutting-edge satellite systems that will also **not add to** the space pollution created by traditional systems. As of now, the company states that it “is targeting service in the Northern U.S. and Canada in 2020, rapidly expanding to near global coverage of the populated world by 2021.” For many, high-speed broadband internet has incredible implications for connectivity.

One of the most important potential benefits of this technology may be its impact on healthcare and access-to-care in **underserved areas**. For decades, it has been a well-recognized fact that [rural sites in America](https://www.npr.org/sections/health-shots/2019/05/21/725118232/the-struggle-to-hire-and-keep-doctors-in-rural-areas-means-patients-go-without-c) have **poor access** to healthcare. This has not been helped by the rising trend of burnout in healthcare professions, in addition to an ever-growing physician shortage. Experts have articulated that the rise of telemedicine may be one possible solution to help with this issue. Digital platforms that can effectively and safely deliver healthcare without regard to distance or location can potentially provide a viable solution to connecting underserved populations with the care they need. The Covid-19 pandemic has been a great test of this technology. As stay-at-home and social distancing orders became the norm this year due to coronavirus, many healthcare systems, and in-turn patients, often had to rely on telehealth for their care needs. Of course, as telehealth services continue to grow, regulators, healthcare professionals, and innovators will need to keep a close eye on many issues that will inevitably emerge, including data-storage concerns, cybersecurity problems, and most importantly, how best to protect patient privacy and information. The latter is especially concerning, given the growing trends in healthcare [cybersecurity breaches](https://www.forbes.com/sites/saibala/2020/10/17/healthcare-cybersecurity-continues-to-be-a-major-concern/) in the past decade. However, if the appropriate oversight bodies can indeed resolve the issues that telemedicine entails, there is significant opportunity for this technology to make an impact. The market has been receptive of this as well, with telehealth companies gaining massive amounts of utilization and market share just this year alone. In fact, [studies indicate](https://www.globenewswire.com/news-release/2020/07/29/2069575/0/en/Telehealth-Market-to-Exhibit-25-2-CAGR-till-2027-Rising-Preference-for-E-visits-Owing-to-Their-Cost-effectiveness-will-Boost-Growth-Fortune-Business-Insights.html) that the telehealth market is poised for a 25.2% CAGR (compound annual growth rate) and a valuation of nearly $559.5 billion by 2027. Nonetheless, one of the most important limiting factors for telemedicine is connectivity. Due to the same degree of distance that causes healthcare shortages in rural areas, these locations often also lack reliable and high-speed internet connections—the kind that is needed to support stable telemedicine applications and platforms.

This is where Starlink could potentially become a game-changer. If the Starlink service can indeed provide high-speed broadband internet services to rural populations, it may **resolve** yet another piece of the puzzle in increasing access-to-care in underserved communities. Furthermore, the applications of this technology are **endless** and go **far beyond** the American paradigm of rural healthcare. Starlink’s concept, if proven to be scalable and effective, may be able to one day provide internet worldwide, providing the opportunity for underserved communities across the globe to receive much needed medical attention.

#### **Telehealth communications solve pandemics**

**Monaghesh and Hajizadeh 20** – Department of Health Information Technology Student Research Committee

[Elham Monaghesh and Slireza Haajizadeh, “ The role of telehealth during COVID-19 outbreak: a systematic review based on current evidence,” BMC Public Health, 08-01/2020, <https://link.springer.com/article/10.1186/s12889-020-09301-4>]

Coronaviruses, a genus of the coronaviridae family, may cause illness in animals or humans [[1](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR1), [2](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR2)]. In humans, several coronaviruses are known to cause infections of respiratory ranging from the common cold to more serious diseases. The most recently discovered coronavirus causes coronavirus disease-19 (COVID-19) [[1](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR1)]. The disease originated in Wuhan, China and has kept spreading widely to other regions of the world [[3](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR3)]. Primitive symptoms of COVID-19 contain fever, dry cough, breathing difficulty, and boredom [[4](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR4), [5](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR5)]. Elderly people and those with underlying medical problems such as hypertension, heart problems, and diabetes are more susceptible to develop the disease in its form of most intensive [[1](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR1)]. This universal event has been announced a pandemic by the World Health Organization (WHO) [[6](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR6)]. A **significant factor** in slowing down the transmission of the virus is the “social gap” or social distancing that is made possible by the reduction of person-to-person contact [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7), [8](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR8)]. To reduce transmission, travel restrictions have been appointed and enforced around the world, and most cities have been quarantined [[9](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR9)]. However, people who are not infected with the COVID-19, especially those who are at greater risk of developing the disease (e.g. Elderly people and those with underlying diseases), should receive daily care without the risk of exposure to other patients in the hospital [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7)]. Moreover, under strict infection control, unnecessary personnel such as clinical psychiatrists strongly refuse to enter COVID-19 patient’s ward [[10](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR10), [11](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR11)]. Natural disasters and epidemics pose many challenges in providing health care [[12](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR12)]. As a result, unique and innovative solutions are needed to address both the critical needs of patients with COVID-19 and other people who need healthcare service. In this respect, technological advances provide new options [[13](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR13)]. Although the ultimate solution for COVID-19 will be multifaceted, it is one of the effective ways to use existing technologies to facilitate optimal service delivery while minimizing the hazard of direct person-to-person exposure [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7), [14](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR14)]. The use of telemedicine at the time of epidemic conditions (COVID-19 pandemic) has the potential to improve research of epidemiological, control of disease and management of clinical case [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7), [14](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR14), [15](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR15)]. The use of telehealth technology is a twenty-first century approach that is both patient-centered and protects patients, physicians, as well as others [[16](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR16), [17](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR17)]. Telehealth is the delivery of health care services by health care professionals, where distance is a critical factor, through using information and communication technologies (ICT) for the exchange of valid and correct information [[18](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR18)]. Telehealth services are renderdusing real-time or store-and-forward techniques [[19](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR19)]. With the rapid evolution and downsizing of portable electronics, most families have at least one device of digital, such as smartphones [[20](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR20)] and webcams that provide communication between patient and healthcare provider [[21](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR21)]. Video conferencing and similar television systems are also used to provide health care programs for people who are hospitalized or in quarantine to reduce the risk of exposure to others and employees [[7](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR7)]. Physicians who are in quarantine can employ these services to take care of their patients remotely [[8](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR8), [22](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR22)]. In addition, covering multiple sites with a tele-physician can address some of the challenges of the workforce [[8](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR8), [23](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR23)]. There are various benefits in using technology of telehealth, especially in non-emergency / routine care and in cases where services do not require direct patient-provider interaction, such as providing psychological services [[24](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR24)]. Remote care **reduces** the use of resources in health centers, improves access to care, while **minimizing** the risk of direct transmission of the infectious agent from person to person [[25](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR25)]. In addition to being beneficial in keeping people safe, including the general public, patients and health workers, another important advantage is providing widely access to care givers [[12](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR12)].. Therefore, this technology is an attractive, **effectual and affordable option** [[14](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR14), [26](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR26), [27](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR27)].

Patients are eager to use telehealth, but hindrances still exist [[28](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR28), [29](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR29)]. The barriers of implementing these programs also largely depend on accreditation, payments systems, and insurance [[8](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR8)]. Furthermore, some physicians are concerned about technical and clinical quality, safety, privacy, and accountability [[23](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR23), [30](https://link.springer.com/article/10.1186/s12889-020-09301-4#ref-CR30)]. Telehealth can become a basic need for the general population, health care providers, and patients with COVID-19, especially when people are in quarantine, enabling patients in real time through contact with health care provider for advice on their health problems. Thus, the aim of this review was to identify and systematically review the role of telehealth services in preventing, diagnosing, treating, and controlling diseases during COVID-19 outbreak. We recognized eight studies that presented precious data on telehealth regarding the status of people infected with COVID-19. Telehealth has the capability to incorporate several organizations and situations of health care into one virtual network, led by the central clinic. This network can contain physical locations in different region: central and remote clinics, prevention centers, private clinics, and, private offices of physicians, centers of rehab state and all registered patients within their locations. By using virtual care for very regular, essential medical care, and deferring elective procedures or yearly checkups, we can free up medical staff and equipment required for those who become seriously ill from COVID-19.

Additionally, by not congregating in small spaces like waiting rooms, the ability of the coronavirus to transmission from one person to another were thwart. Keeping people discrete is called “social distancing”. Keeping healthcare staffs discrete from patients and other providers is “medical distancing”. In present time the Telehealth is one strategy to help us carry out this. Telehealth can mobilize all aspects of healthcare potentials to decrease transmission of disease, conduct people to the right level of health care, ensure safety for provide health services online, protect patients, clinicians, and the community from exposure to infection, and finally diminish the burden on the healthcare providers and health system. Some of the telehealth usage cases for patients were control and triage during the outbreak of COVID-19 pandemic, self and distance monitoring, treatment, patients after discharge in health centers (follow-ups) and implementation of online health services. These methods have the potential to **reduce morbidity and mortality during pandemic**. For all healthcare workers and clinicians with mild symptoms can still work remotely with patients, facilitate quick access to medical decision making, seek second opinion for severe cases of patients, exchange cross-border experiences, and offer teleradiology and online trainings for health workers. To provide continued access to necessary health services, telehealth should be a **key weapon** in the fight against the COVID-19outbreak.

#### **Next pandemic causes extinction**

**Bhadelia, 21** -- Center for Emerging Infectious Diseases Policy & Research founding director

[Nahid, MD, MALD, "What do we need to build resilience against the next pandemic?," Center for Emerging Infectious Diseases Policy & Research, 5-18-2021, https://www.bu.edu/ceid/2021/05/18/placeholder-blog-post/, accessed 10-18-2021]

What do we need to build **resilience** against the **next pandemic**?

We have lost close to 3.4 million souls to COVID-19 globally over the last year. By some estimates, the real number may be much higher than that because the excess deaths this year are closer to between 7 and 13 million, after accounting for those who died without a diagnosis and those who died because they could not receive timely care for another medical condition. And the pandemic, despite the receding cases in high-resource countries, is nowhere near its end.

Lives lost are the tip of iceberg. We cannot quantify the pain felt by family members remaining behind. Livelihoods and businesses have been devastated. The pandemic’s impact reaches into all recesses of our personal and public lives. It has and will continue to undo decades of work globally on reducing poverty, improving education and health, and empowering women. An IMF study last year showed how, in the five years after major epidemics, incomeinequality continues to increase in affected countries. Similar trends are already being seen in five countries with the heaviest death tolls from COVID-19. As communities around the world deal with the wreckage of their economies, 95 million more people have been pushed into extreme poverty, with another 200 million predicted to be at risk between now and the year 2030. And this does not even cover the multidimensional impact of poverty. How long will it take for us to recover from this pandemic? How do we take stock and pandemic-proof our communities?

More urgently, COVID-19 may not be the last pandemic we face in our lifetimes. The **existential threat** of pandemics doesn’t decrease because we are already facing one. In fact, this pandemic worsens the risk for new threats because our effort and resources are depleted, and our surveillance and healthcare systems are overstretched. And because the risk of new infectious diseases seeping into the human population from **animal reservoirs** is going to continue to grow as we see grow in numbers, require more land, raise more animals, put down more roads, use up more wetlands, and close the gap between us and natural habitats where yet **undiscovered viruses** lurk. How can we ensure that economically devastated communities coming out of this pandemic recover without worsening the tenuous balance we have with the world around us?

Within our own lifetimes, we have seen the impact of climate change, another existential crisis, transition from something we heard about in news reports to something we experience in our personal lives in the form of changing weather patterns, health effects, increased risk of natural disasters, and rising sea levels. Over the next decades, these factors will exponentially increase the incidence of many infections and change the distribution of others.

And as we tackle these complex problems, new challenges are arising: despite becoming ever more globally connected, our perceptions of reality continue to be disparate. In the deluge of digital data, many among us are falling prey to misinformation and disinformation. The urgency of outbreaks, the shifting scientific knowledge base that comes from tackling emerging pathogens, and political interference have all contributed to the signal getting lost in the noise. The role of disinformation is only going to expand in future emergencies. How do we share timely information in crisis? How do we, in government, science, and public health, earn and build the trust of our communities so ours is the voice they listen to during the fray? How do we listen more carefully to them? How do we involve them in making us all safer?

We can no longer ignore infectious threats on the other side of the world, and we can no longer practice isolationist policies. Because COVID-19 painfully instructed us that outbreaks aren’t just something that happen on the news in distant communities, but instead, they can reach into our homes and rip away our loved ones.

There are moments in history when our actions require collective metacognition and urgency. This has to be one of those moments.

The Center for Emerging Infectious Diseases (CEID) Policy & Research was founded because the time is now for collective transdisciplinary research and response. Every step of the way in this pandemic, the questions haven’t been just scientific, they have also been legal, economic, cultural, and ethical. CEID’s mission is to tug at the threads of all the complex systems that leave us vulnerable to new epidemics and help us answer some of the questions posed above. Through research, collaborative action, community engagement, and training, we hope to find ways to secure us against future global threats. I hope you will reach out with ideas, collaborate with us, and check back often to see where our work is taking us.

We are not rudderless as we head into this future. The COVID-19 pandemic, like recent Ebola virus disease outbreaks and other recent emergencies, has shown that investment in sciences, global collaboration, **public health**, and health-systems readiness can decrease our vulnerability. We need not only to invest in diagnostics, vaccines, and therapeutics but also find a new way of approaching the problems. My own experience serving as an outbreak responder in multiple emergencies has underscored for me again and again that epidemics fracture us along lines of existing weakness. Because at the terminus of all international surveillance for outbreaks are many communities that do not have access to care. When families can’t access care, we can’t stop cases from becoming clusters, which then become outbreaks. When communities can’t equitably access vaccines, it makes it harder for them to recover, and we continue to suffer collectively from the global economic impact and through the appearance of new variants. When structural racism keeps parts of our communities from being protected, diagnosed, and cared for, all of us are at risk. When it comes to infectious diseases outbreaks, health inequity is a threat to all our survival.

At the launch of our center, we asked public health experts and scientists, “What do we need to do to build resilience against the next pandemic?” Over the next few months, we will continue asking this question to different disciplines, covering those working on health and economic equity, lawmakers, the business community, artists and musicians, and those in media and journalism. Because the solutions, like the questions, require all of us.

CAP ADV ANSWERS

#### **Growth is sustainable- they underestimate tech innovation that growth drives**

Perez, 16 -- University College London Institute for Innovation and Public Purpose professor

[Carlota, "Capitalism, Technology and a Green Global Golden Age: The Role of History in Helping to Shape the Future," BTTR, 2016, beyondthetechrevolution.com/wp-content/uploads/2014/10/BTTR\_WP\_2016-1.pdf, accessed 10-4-20]

In this chapter, I shall argue that what all of these divergent views on technology and growth share is the absence of a proper historical understanding of innovation: of its nature, of the interactions it generates in the economy, and of the regularity in the technological upheavals from which innovation has sprung since the first Industrial Revolution. Although it is difficult to find an economist today who will not accept that innovation is a key driver of economic growth, it remains almost impossible for them to express its impact adequately in orthodox models. Increases in labour productivity through the change in proportions of labour and capital do reflect process innovations, but the impact of radical product innovations can neither be expressed nor predicted. Such truly new capital goods and infrastructures as (historically) steamships, railways and computers, which cost less and less at the same time as their influence on growth and society becomes more and more powerful, are probably the most dynamic inducers of growth. The specific nature of these technologies is not easily measurable, and there are hardly any comparable statistics of such "*game-changers*" across the past two centuries, so they *are routinely ignored*. Yet this oversight is a waste of one of the richest sources of knowledge about how growth comes about and how jobs are created and destroyed.

Similar problems with measurement and analysis have led many economists and policymakers to see a conflict between growth potential and environmental concerns. Orthodox economics has long struggled to deal appropriately with the role of natural resources in the economy. Decades of low and decreasing cost of energy and raw materials made it seem reasonable to ignore their impact, and thus both the concept of output per hour and of the ambitiously-named 'total factor productivity fail to measure the productivity of resources. Nor have many attempts been made to incorporate the role of innovation in resource use. In 1956, Solow proposed that the nature of technology should be recognised as being wider than just the contributions of capital and labour, measuring its total contribution as the unexplained 'residual' after those had been taken into account.4 Half a century later, with environmental and energy issues becoming pressing concerns, Ayers et al. suggested introducing the efficiency of energy into the models.5 But such approaches do not go very far in analysing the role of concrete innovations in productivity and growth, much less in guiding growth and employment policy. Over recent years, as the high volatility and uncertainty of resource prices have become the 'new normal', energy and materials conservation and raising the productivity of resource use have increasingly become strategic business goals.6 Yet such innovation is not taken into account in the usual analyses of growth. Instead, the environmental regulations that have prompted such innovations are often perceived as growth suppressors.7

Meanwhile, the calls for zero growth or de-growth coming from the environmental movement also stem from an incorrect assumption: that the only possible patterns of growth available are those of the resource-based forms of mass production which shaped most of the twentieth century. Both these opposing camps see a conflict between economic growth and environmental concerns. Yet both have largely ignored the evidence that new information and materials technologies, if well guided towards environmental ends, have the potential to radically reduce the material and energy content of consumption patterns and production methods. Such a direction for innovation can stimulate profitable investment, bring growth, and allow millions of new consumers in the developing world to adopt highly satisfying lifestyles - albeit very different in kind to 20th century notions of good living. This possibility was identified as early as 1973 by Chris Freeman and other evolutionary economists at the University of Sussex, who argued that well-directed technological change could curb waste and excessive use of energy and resources without bringing growth to a halt.8 Such studies have snowballed since, with 'green growth' analyses and associated policy proposals now beginning to emerge even from mainstream economic organisations such as the World Bank and OECD. The 2014 report of the Global Commission on the Economy and Climate, Better Growth, Better Climate, has been particularly influential.9 Yet in wider economic and environmental debate the confusion persists. The need to understand the processes of technical change and the ways in which major new technologies have historically been assimilated and shaped since the industrial revolution is as urgent for the environmental movement as it is for orthodox economics.

#### **Capitalism is self-correcting and sustainable---war and environmental destruction are not profitable and innovation solves their impacts**

Kaletsky 11 – (Anatole, editor-at-large of *The Times* of London, where he writes weekly columns on economics, politics, and international relations and on the governing board of the New York-based Institute for New Economic Theory (INET), a nonprofit created after the 2007-2009 crisis to promote and finance academic research in economics, Capitalism 4.0: The Birth of a New Economy in the Aftermath of Crisis, p. 19-21 /DOA: 6/28/2018)//JDi

*Democratic capitalism is a system built for survival*. It has adapted successfully to shocks of every kind, to upheavals in technology and economics, to political revolutions and world wars. Capitalism has been able to do this because, unlike communism or socialism or feudalism*, it has an inner dynamic akin to a living thing. It can adapt and refine itself in response to the changing environment*. And it will evolve into a new species of the same capitalist genus if that is what it takes to survive. In the panic of 2008—09, many politicians, businesses, and pundits forgot about the astonishing adaptability of the capitalist system. Predictions of global collapse were based on static views of the world that extrapolated a few months of admittedly terrifying financial chaos into the indefinite future. The self-correcting mechanisms that market economies and democratic societies have evolved over several centuries were either forgotten or assumed defunct. The language of biology has been applied to politics and economics, but rarely to the way they interact. *Democratic capitalism’s equivalent of the biological survival instinct is a built-in capacity for solving social problems and meeting material needs. This capacity stems from the principle of competition, which drives both democratic politics and capitalist markets*. Because market forces generally reward the creation of wealth rather than its destruction, they direct the independent efforts and ambitions of millions of individuals toward satisfying material demands, even if these demands sometimes create unwelcome by-products. Because voters generally reward politicians for making their lives better and safer, rather than worse and more dangerous, *democratic competition directs political institutions toward solving rather than aggravating society’s problems, even if these solutions sometimes create new problems of their own.* Political competition is slower and less decisive than market competition, so its self-stabilizing qualities play out over decades or even generations, not months or years. But regardless of the difference in timescale, capitalism and democracy have one crucial feature in common: Both are mechanisms that encourage individuals to channel their creativity, efforts, and competitive spirit into finding solutions for material and social problems. And in the long run, these mechanisms work very well. If we consider democratic capitalism as a successful problem-solving machine, the implications of this view are very relevant to the 2007-09 economic crisis, but diametrically opposed to the conventional wisdom that prevailed in its aftermath. Governments all over the world were ridiculed for trying to resolve a crisis caused by too much borrowing by borrowing even more. Alan Greenspan was accused of trying to delay an inevitable "day of reckoning” by creating ever-bigger financial bubbles. Regulators were attacked for letting half-dead, “zombie” banks stagger on instead of putting them to death. But these charges missed the point of what the democratic capitalist system is designed to achieve. *In a capitalist democracy whose raison d’etre is to devise new solutions to long-standing social and material demands, a problem postponed is effectively a problem solved.* To be more exact, a problem whose solution can be deferred long enough is a problem that is likely to be solved in ways that are hardly imaginable today. Once the self-healing nature of the capitalist system is recognized, the charge of “passing on our problems to our grand-children”—whether made about budget deficits by conservatives or about global warming by liberals—becomes morally unconvincing. Our grand-children will almost certainly be much richer than we are and will have more powerful technologies at their disposal. It is far from obvious, therefore, why we should make economic sacrifices on their behalf. Sounder morality, as well as economics, than the Victorians ever imagined is in the wistful refrain of the proverbially optimistic Mr. Micawber: "Something will turn up."

#### **No ‘space war’ – Insurmountable barriers and everyone has an interest in keeping space peaceful**

**Dobos 19**

[(Bohumil Doboš, scholar at the Institute of Political Studies, Faculty of Social Sciences, Charles University in Prague, Czech Republic, and a coordinator of the Geopolitical Studies Research Centre) “Geopolitics of the Outer Space, Chapter 3: Outer Space as a Military-Diplomatic Field,” Pgs. 48-49] TDI

Despite the theorized potential for the achievement of the terrestrial dominance throughout the utilization of the ultimate high ground and the ease of destruction of space-based assets by the potential space weaponry, the utilization of space weapons is with current technology and no effective means to protect them far from fulfilling this potential (Steinberg 2012, p. 255). In current global international political and technological setting, the utility of space weapons is very limited, even if we accept that the ultimate high ground presents the potential to get a decisive tangible military advantage (which is unclear). This stands among the reasons for the lack of their utilization so far. Last but not the least, it must be pointed out that the states also develop passive defense systems designed to protect the satellites on orbit or critical capabilities they provide. These further decrease the utility of space weapons. These systems include larger maneuvering capacities, launching of decoys, preparation of spare satellites that are ready for launch in case of ASAT attack on its twin on orbit, or attempts to decrease the visibility of satellites using paint or materials less visible from radars (Moltz 2014, p. 31). Finally, we must look at the main obstacles of connection of the outer space and warfare. The first set of barriers is comprised of **physical obstructions**. As has been presented in the previous chapter, the outer space is very challenging domain to operate in. Environmental factors still present the largest threat to any space military capabilities if compared to any man-made threats (Rendleman 2013, p. 79). A following issue that hinders military operations in the outer space is the predictability of orbital movement. If the reconnaissance satellite's orbit is known, the terrestrial actor might attempt to hide some critical capabilities-an option that is countered by new surveillance techniques (spectrometers, etc.) (Norris 2010, p. 196)-but the hide-and-seek game is on. This same principle is, however, in place for any other space asset-any nation with basic tracking capabilities may quickly detect whether the military asset or weapon is located above its territory or on the other side of the planet and thus mitigate the possible strategic impact of space weapons not aiming at mass destruction. Another possibility is to attempt to destroy the weapon in orbit. Given the level of development for the ASAT technology, it seems that they will prevail over any possible weapon system for the time to come. Next issue, directly connected to the first one, is the utilization of weak physical protection of space objects that need to be as light as possible to reach the orbit and to be able to withstand harsh conditions of the domain. This means that their protection against ASAT weapons is very limited, and, whereas some avoidance techniques are being discussed, they are of limited use in case of ASAT attack. We can thus add to the issue of predictability also the issue of easy destructibility of space weapons and other military hardware (Dolman 2005, p. 40; Anantatmula 2013, p. 137; Steinberg 2012, p. 255). Even if the high ground was effectively achieved and other nations could not attack the space assets directly, there is still a need for communication with those assets from Earth. There are also ground facilities that support and control such weapons located on the surface. Electromagnetic communication with satellites might be jammed or hacked and the ground facilities infiltrated or destroyed thus rendering the possible space weapons useless (Klein 2006, p. 105; Rendleman 2013, p. 81). This issue might be overcome by the establishment of a base controlling these assets outside the Earth-on Moon or lunar orbit, at lunar L-points, etc.-but this perspective remains, for now, unrealistic. Furthermore, **no contemporary actor will risk full space weaponization in the face of possible competition and the possibility of rendering the outer space useless.** No actor is dominant enough to prevent others to challenge any possible attempts to dominate the domain by military means. To quote 2016 Stratfor analysis, "(a) war in space would be devastating to all, and preventing it, rather than finding ways to fight it, will likely remain the goal" (Larnrani 20 16). This stands true unless some space actor finds a utility in disrupting the arena for others.

**Cap key to new tech that solves climate change- alts fail**

Schwartzman, 20 -- Howard University biogeochemist and professor

[David, "An Ecosocialist Case for CO2 Removal Technology," Climate & Capitalism, 3-7-2020, https://climateandcapitalism.com/2020/03/07/ecosocialist-case-for-co2-removal/, accessed 10-4-2020]

The greatest challenge facing humanity now is the implementation of massive prevention program to confront the ever growing threat of C3. Further, as an *ecosocialist*, I submit that this prevention program cannot wait until fossil capitalism is replaced globally by ecosocialism. This prevention program must prioritize rapid and radical curbs on GHG emissions coupled with NEC and the rapid transition to 100 percent global wind and solar power supplies.

Without negative carbon emissions humanity will still face a climate hell future much worse than the horrors we now witness from climate change. A Global Green New Deal, increasing inspired by an ecosocialist perspective is arguably a path forward: see e.g., Aronoff et al. (2019) and Schwartzman and Schwartzman (2019).

While class struggle in every dimension informed by an ecosocialist agenda is still too weak to prevent the all deficiencies and risks identified by Linda Schneider in this transition, as the global climate and energy justice movement gains strength, then the opportunity to create a more sustainable and just solar transition will grow. But the creation of a wind/solar energy infrastructure and a NEC capacity should be welcomed now. *We cannot wait for the end of* the rule of *capital* to start building these imperative technologies, *it will be too late*.

The atmospheric level of carbon dioxide, now a bit over 410 ppm, will not go below the safe level of below 350 ppm and kept there unless ongoing sequestration from the atmosphere into the crust is done for the foreseeable future because the ocean with its vast stores of carbon will continuously release it back into the atmosphere.

As one climate science group put it, “…CDR can be a *game changer* for climate policy in the sense that it significantly improves feasibility and cost considerations for achieving stringent climate stabilization. It is, however, a complement, not a substitute to the traditional approach of mitigating emissions at their source” (Kriegler et al., 2013, 55).

This is why carbon sequestration from the atmosphere into the crust is absolutely imperative and it will require a rapid replacement of fossil fuels by a global solar power supply. We estimate a requirement of this energy (in power units) dedicated to this mode of sequestration to be on the order of 4 trillion watts for a strong carbon emission reduction of 6% per year scenario (Hansen et al., 2017), with the present primary consumption being 19 trillion watts (Schwartzman and Schwartzman 2019).

Now estimates point to the need for even more aggressive reduction per year to achieve the 1.5 deg C target (e.g., Lenton et al., 2019). A greater global energy supply than now is also required to eliminate energy poverty afflicting the global South as well as having the capacity to address climate adaptation and other challenges such as cleanup of the legacy of the military industrial complex (Schwartzman, 2016, 2017). Buck (2019) likewise argues that a massive increase in global renewable energy capacity will be needed for climate mitigation. So *even with eliminating* carbon *emissions*, forgoing this form of carbon sequestration is a recipe for climate disaster.

#### **We control uniqueness- pollution massively declining now- most recent comprehensive studies**

Lomborg, 20 -- former director of the Danish government's Environmental Assessment Institute

[Bjorn Lomborg, president of the Copenhagen Consensus and a visiting fellow Stanford University’s Hoover Institution, "50 years after the first Earth Day, the planet’s doing pretty well," New York Post, 4-21-2020, https://nypost.com/2020/04/21/50-years-after-the-first-earth-day-the-planets-doing-pretty-well/, accessed 10-4-2020]

50 years after the first Earth Day, *the planet’s doing* pretty *well*

Wednesday marks the 50th anniversary of Earth Day and the birth of the modern environmentalist movement. Half a century later, we might pause and ask: How is our planet doing? The answer: pretty well, actually.

We have much to celebrate — and much to think about as we consider ways we can make the next 50 years more effective.

Many Westerners are surprised to hear that the ­environment is improving. A lot. This surprise owes to an unfortunate flip side of the Earth Day legacy, which too often can ­focus on doom and gloom, making us despondent and driving poor policies.

Early environmentalism from the 1970s helped focus societies on important environmental priorities such as polluted rivers — the Cuyahoga River even infamously caught fire in 1969 — and fouled air, with soot and smog killing millions.

Here, we’ve made *great strides*. Most bodies of water in rich countries are much cleaner, since we are *prosperous enough to clean up* our messes.

In America, for instance, a *recent comprehensive study* showed that “*water pollution* concentrations have fallen substantially” over the past 50 years. And a stunning 3.8 billion people in the world have gained access to clean drinking water since the 1970s.

Air pollution, *the world’s biggest environmental killer*, has seen *even greater improvements*. Outdoor *air pollution* has *declined dramatically* in rich countries, in no small measure due to attention from the 1970 Earth Day and the legislation it inspired, such as the landmark US Clean Air Act enacted later that year.

For the world’s poor, the deadliest air pollution is ­indoors. Almost 3 billion of the world’s poorest still cook and keep warm with dirty fuels like dung, cardboard and wood, and the World Health Organization estimates the effects are equivalent to smoking two packs of cigarettes daily.

Since 1970, the death risk across the world from indoor air pollution has been cut by more than half.

EXPLORATION ADV ANSWERS

**They took out their own link- concede space travel impossible- biology. That makes impossible to get off the rock.**

#### **Colonization doesn’t reduce existential risk** – Earth-bound threats outweigh even in long term risk management

- Short- and long-term risk assessment should focus on protecting earth

- Earth gets riskier as tech advances which raises the risk that our impact happens before colonization

- Even if tech gets there, future social and economic context prevents missions

- Risk Dynamics Paradox – existential risks are rooted in human psychology, so they’ll follow us to space – Bostrom agrees!

Szocik 19 [Konrad Szocik, University of Information Technology and Management in Rzeszow, Department of Philosophy and Cognitive Science. Should and could humans go to Mars? Yes, but not now and not in the near future. Futures Volume 105, January 2019, Pages 54-66. https://www.sciencedirect.com/science/article/pii/S001632871830199X]

I argue, following other authors (Baum, 2009; Baum, Denkenberger, & Haqq-Misra, 2015; Jebari, 2015; Sandberg, Matheny, & Ćirković, 2008; Turchin & Green, 2017) that human *space settlement* is *not able* to *reduce* and/or to exclude the *risk* of *human extinction*. For this reason, it should *not be perceived* in terms of space *refuge*. In terms of *both* *short-term and long-term* perspectives of *risk assessment*, it would be *better* to *protect humans on Earth*.5 I reject the supportive role which could be played by human space settlement after a catastrophe on Earth, i.e., a recovery coordination mission. Due to so-called the paradox of technological progress discussed in the last section, further putative progress in space technology will be counterbalanced by increasing *anthropogenic risks* including, among others, overpopulation and limited resources (these anthropogenic threats are unavoidable in near future, in contrast to other risks that are only more or less probable but not unavoidable). Permanent lack of strong rationale for human mission to Mars – both now and in the near future – leads to paradoxical situation. *Even if* in some point in the future the *minimum* level of advancement in human deep-space technologies will be achieved, *social*, *political*, and *economic* contexts will gradually *decrease* the *chances* for real *preparation* of this mission. Another paradox, let’s call it the *risk dynamics paradox*, is that the most probable threats in the near future are, as *Bostrom* and Cirkovic (2008) *argue*, *anthropogenic threats* caused by civilizational and technological progress. The paradox lies in the fact that humans are *not able to run* from these kinds of risks that are *rooted* in *their way of thinking*, *style of life*, and *population dynamics*, risks implied by Malthus’ law. The human species can try to protect against natural disaster but not against deleterious effects of its own technological progress. In regard to possible future existential risks, I assume that their deleterious power is a little bit exaggerated, and, in any event, human space settlement is not a right way to cope with them. However, in any case, it is hard to speculate if any human space settlement must repeat the same path of human expansion as it was the case on Earth. It is unclear if human technological expansion and exploration must always lead to deleterious and self-destructive effects. In this paper, I do not discuss ethical and moral concerns which are traditionally considered when discussing the human place in space. They include such topics as the human right to explore space (it means both right to intervene in any extraterrestrial object, and human duty and rationale for space expansionism, mostly in the context of the idea of space refuge and possible catastrophic scenarios on Earth), or the value of human life and space objects.

#### **Warming doesn’t cause extinction- assumes worst case scenerios**

#### **Marris, 21 –** institiute fellow at UCLA institute of environment and sustainability

[Emma, “We’re Heading Straight for a Demi-Armageddon,” Atlantic, 11-3-2021, https://amp.theatlantic.com/amp/article/620605/, accessed 11-5-2021]

The COP26 international climate-change negotiations have just begun in Glasgow, Scotland, and the vibes are … ambivalent. The leaders of Russia and China haven’t bothered to attend, but did promise to help [end deforestation](https://www.theatlantic.com/science/archive/2021/10/new-bipartisan-plan-reduce-illegal-deforestation/620361/) by 2030—though many observers are skeptical that they will keep their word. In the United States, President Joe Biden’s “Build Back Better” plan lost a [powerful provision](https://www.theatlantic.com/science/archive/2021/10/biden-cannot-declare-victory-climate-without-these-policies/620413/) that would have helped convert the nation’s electricity grid to renewable energy, but still includes [an unprecedented $555 billion](https://www.theatlantic.com/science/archive/2021/10/whats-actually-joe-bidens-new-climate-proposal/620543/) to combat climate change.

In a prelude to the conference, [the UN added up](https://unfccc.int/news/updated-ndc-synthesis-report-worrying-trends-confirmed) the most recent pledges of parties to the 2015 Paris Agreement. If all 192 keep their promises, the synthesis found, the planet would still be on track to warm 2.7 degrees Celsius, or 4.9 degrees Fahrenheit, by the end of the century. This is nearly twice the 1.5-degree-Celsius (2.7 Fahrenheit) goal agreed to in principle in Paris. But it is also not nearly the jump predicted in the hottest scenario envisioned in the [latest report](https://www.ipcc.ch/report/ar6/wg1/#SPM) by the Intergovernmental Panel on Climate Change—4.4 degrees Celsius, or 8 degrees Fahrenheit.

The world is wandering into a kind of gray area between total failure and real global commitment to containing global warming. In a recent video call to supporters, [Varshini Prakash](https://twitter.com/VarshPrakash), the head of the Sunrise Movement, which advocates for aggressive action on climate change, said she felt two ways at once—proud “that we forced Democrats and the president to care about our generation” and also angry.

“I feel disappointed that this is all that we’ve won,” she said.

It is hard to know how to feel. A future of possibly 5 degrees Fahrenheit of warming seems like an unknown country. Is it a civilization-ending crisis? Or is it a more familiar version of awful—a bit sweatier, more chaotic, and less just than the world we currently inhabit?

[Brian O’Neill](https://www.pnnl.gov/news-media/brian-oneill-named-new-director-joint-global-change-research-institute), the director of the Joint Global Change Research Institute, a partnership between the U.S. Department of Energy and the University of Maryland at College Park, has a clearer view of this question than most of us. He was one of the lead architects of the five different futures—called “shared socioeconomic pathways,” or SSPs—[developed for the latest IPCC report](https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf).

These five futures aren’t just versions of 2100 at different temperatures. [Each started with a different idea about how society might develop](https://www.researchgate.net/profile/Marc-Levy-7/publication/272423967_The_roads_ahead_Narratives_for_shared_socioeconomic_pathways_describing_world_futures_in_the_21st_century/links/5e7dd26f458515efa0adb82b/The-roads-ahead-Narratives-for-shared-socioeconomic-pathways-describing-world-futures-in-the-21st-century.pdf). The SSP 1 pathway, which keeps us under that 1.5-degree-Celsius goal, for example, is the “Sustainability” path. In this scenario, the global economy still expands, but humanity “shifts toward a broader emphasis on human well-being, even at the expense of somewhat slower economic growth over the longer term.” The highest-temperature scenarios are SSP 4, in which inequality accelerates to even more grotesque levels, but advanced technology zaps some emissions, and SSP 5, where the world simply charges forward with fossil-fuel-powered turbo-capitalism.

The path we seem to be on, at least for now, looks closer to SSP 2, which the authors call “Middle of the Road.” This is a world in which “social, economic, and technological trends do not shift markedly from historical patterns.” A world, in other words, in which we do not heroically rise to the occasion to fix things, but in which *we also don’t get much worse than we already are*.

So what does this SSP 2 world feel like? It depends, O’Neill told me, on who you are. One thing he wants to make very clear is that *all the paths, even the hottest ones, show improvements in human well-being on average.* IPCC scientists expect that average life expectancy will continue to rise, that poverty and hunger rates will continue to decline, and that average incomes will go up in every single plausible future, simply because they always have. “There isn’t, you know, like a *Mad Max* scenario among the SSPs,” O’Neill said. Climate change will ruin individual lives and kill individual people, and it may even drag down rates of improvement in human well-being, but on average, he said, “we’re generally in the climate-change field not talking about futures that are worse than today.”

But all the current physical impacts of climate change—drought, extreme heat, fire, storms, sea-level rise—would get [significantly worse](https://interactive.carbonbrief.org/impacts-climate-change-one-point-five-degrees-two-degrees/?utm_source=web&utm_campaign=Redirect) by 2100 under SSP 2. And say goodbye to coral reefs. “At 2.5 degrees [Celsius], it’s probably a world in which we don’t have them,” O’Neill said. “They don’t exist.” The Arctic? “My guess is that we would have a permanently ice-free Arctic in the summer. And so we would have all of the ecological consequences that would come along with that.”

*All the IPCC scenarios might be wrong*. They’re using statistical extrapolation and models, and as O’Neill reminded me, history is always wilder than people expect. (Just as *Mad Max* scenarios are missing from the SSPs, so are “[no growth](https://www.boell.de/sites/default/files/endf2_kuhnhenn_growth_in_mitigation_scenarios.pdf)” scenarios.) But the world we are heading toward may be one in which the average human is living longer and making more money than ever, but some vulnerable humans and many nonhumans are collateral damage.

This is why many climate activists frame *global warming as a problem of justice*.

[John Paul Jose](https://twitter.com/johnpauljos) is a young climate activist based in Kerala, India, where [a series of flash floods linked to climate change have killed hundreds of people since 2018](https://www.hindustantimes.com/india-news/extreme-weather-events-in-kerala-linked-to-climate-crisis-experts-101634668375094.html). “In all seasons throughout the year, there is cyclones, extreme rainfall and flood, heat waves,” he says. “And the place where I live is an ecologically fragile and sensitive hill, an extension of Western Ghats. The immediate danger we have is of landslides and flooding in low-lying areas. So anything could happen in future; the only thing is to live in fear and hope.” He wants to see drastic emissions cuts promised at COP26, along with serious money flowing from rich countries that have historically emitted the most toward poor communities where the impacts are the worst. At COP16, in 2010, wealthy nations promised to send $100 billion a year to “developing countries” by 2020, but [Oxfam International estimates](https://oxfamilibrary.openrepository.com/bitstream/handle/10546/621066/bp-climate-finance-shadow-report-2020-201020-en.pdf) that climate-specific net assistance is currently more like $20 billion a year.

Climate advocates like Leah Stokes, a political scientist at UC Santa Barbara and an adviser to congressional Democrats on climate policy, are determined to find a way through this gray area. For her, the action that is happening is a motivation to push for even more action. “If they are able to pass this bill, it won’t just be okay; it will be transformative,” she told me. But there’s more to do after the celebrations. “The climate crisis is not going to be solved in one bill. Every ton matters. Every dollar we get invested in this matters. It all adds up,” she said.

Fighting for incremental investment dollars is not as dramatic as a single sweeping intervention to avoid total planetary ruin, and activists moved by horrific visions of human extinction may not be as motivated by the quest to steer the globe from SSP 2 to SSP 1, to shave just a few degrees off the total average warming. But anyone who needs an apocalypse to focus on can rest assured that it’s happening, unequally, for some. Even at today’s 1 degree Celsius (1.8 degrees Fahrenheit) of warming, for many individual people, communities, and species, climate change has already meant the end of their world.

#### **Capitalist competition key to space exploration**

Jack Hipkins 18 (Jack Hipkins, Jack Hipkins is an Advocate for Young Voices based in San Diego, California. He writes about U.S. foreign policy, taxes, and economic theory., 6-28-2018, "Competition Is Launching a New Golden Age of Space Travel," FEE, https://fee.org/articles/competition-is-launching-a-new-golden-age-of-space-travel/, Accessed: 7-1-2018 /Kent Denver-YBJL)

When Elon Musk founded SpaceX in 2002, he celebrated with the company's eight employees by inviting a mariachi band to come and play in their empty office. It was a relatively unassuming start for a company founded to make humanity a “true spacefaring civilization.” Yet for all the attention the company has garnered recently, far less has focused on the remarkable degree to which *competition has spurred the 21st century's space race*. Impact of The United Launch Alliance For nearly a decade, Lockheed Martin and Boeing were the only major American players in the launch vehicle market. After years of fierce competition, the two companies agreed to join forces and created United Launch Alliance (ULA) in 2005. At the time ULA’s position seemed unassailable—Lockheed Martin and Boeing employed nearly 300,000 people across the world, and had combined revenues of over $90 billion. In addition, their partnership essentially gave ULA a monopoly over US military launches. But as so often happens in a non-competitive environment, prices quickly began to soar. By 2012, the price that ULA charged the military per mission had increased 58 percent above the baseline estimates in 2004 and 2007. The rapid increase spurred a governmental review of ULA’s program, which found that despite dealing with fewer launches over time, ULA’s costs continued to grow. The review stated that "the final cause is poor program execution due to an environment in which little incentive for cost control, or threat of termination exists." Introducing Competition into the Market Meanwhile, SpaceX had been forging ahead towards its goal of creating cost-effective launch vehicles. Despite facing several setbacks, SpaceX successfully launched the world's first privately funded and developed rocket in September 2008. Several months later, SpaceX was awarded a NASA commercial cargo contract to resupply the International Space Station (ISS) as part of the Commercial Resupply Services (CRS), and its share of the launch vehicle market has been increasing ever since. One of the keys to SpaceX’s success has been its ability to substantially undercut the prices of its competitors. While SpaceX lists its Falcon 9 rocket starting at $62 million a flight, the US Air Force budgeted $422 million for a single ULA flight in 2020. This trend has held true within NASA's CRS program as well. According to a NASA report released in April, the average cost of a SpaceX mission to resupply the ISS was $152.1 million, compared to an average of $262.6 million for its competitor Orbital ATK. Indeed, the audit also noted that SpaceX’s competitive pricing “has contributed to lower prices for NASA launches,” with the cost for the ULA standard Atlas V rocket decreasing by around $20 million per launch after SpaceX’s Falcon 9 rocket became eligible to compete for launch contracts. SpaceX’s dramatic price increase could provide an ideal opening for other space companies. But while Space X's meteoric rise has been fueled by its comparatively low-cost, it appears that that all may be about to change. In the same report, the authors revealed that SpaceX is raising the price it will charge NASA for future resupply missions to the ISS by around 50 percent. This comes at a time when SpaceX’s primary competitor for resupply missions, Orbital ATK, recently announced a 15 percent reduction to its costs. These shifts will all but eliminate the price gap between Orbital ATK and SpaceX. SpaceX’s dramatic price increase could provide an ideal opening for other space companies. In addition to Orbital ATK and SpaceX, Sierra Nevada Corporation received a contract to resupply the ISS as part of NASA's second round of CRS. Although relatively new to resupply missions, Sierra Nevada is seen as a high-quality competitor to its more experienced cohorts. It's even possible that new contenders could enter the fray going forward. Included in the contract NASA signed with these companies is an on-ramp clause, which allows companies outside the contract to place bids to compete for future cargo missions. With companies like Jeff Bezos’ aerospace company, Blue Origin, rapidly ramping up investments in commercial space travel, the landscape seems ripe for competition. Given renewed national interest in space travel, and burgeoning investment flows into aerospace companies, *it's clear that we are entering into a new golden age of space travel*. As the US government moves to increase spending on NASA, it would do well to remember that *competition is what will get us to the stars. The government should not play favorites with any company in particular, but rather foster a competitive bidding environment to accelerate humanity’s future.*

**Turn- Cap key to space**

Ashworth, 10 -- British Interplanetary Society fellow

[Stephen Ashworth, "Towards the Sociology of the Universe: Towards a Universal Society," Astronist, 12-18-10, http://www.astronist.co.uk/astro\_ev/2000/Sociology2.shtml, accessed 10-4-2020]

There are thus two plausible end-points to our current phase of growth: collapse back to a pre-industrial level (the supernova burns out), or continued growth taking us onto a sustainable level of technological maturity (the baby grows up).

The difference between these two future courses is immense. In terms of population, the carrying capacity of Earth for human populations is greater than the current 6 or 7 billion, but not very much so, perhaps a few tens of billions (depending on the technologies available). Any retreat to medieval levels of technology would cut this figure by a factor of ten, probably down to less than a billion.

But the *carrying capacity* of the Solar System is at least a *million times greater* than that of a high-tech Earth, and that of the Galaxy at least a billion times greater again than that of the Solar System. The present-day situation of human society is therefore that it finds itself at a cross-roads of unparalleled significance.

If growth is not maintained, then, unless they can reignite that growth phase, our descendants are forever restricted to planet Earth. But must they necessarily fall back to a medieval or even more primitive level? Could industrial civilisation survive for a while in a zero-growth phase at around its present-day level of development, and if so, for how long?

In any discussion of mankind and space, this is a key question which must be addressed. Certainly, pre-industrial civilisations have survived with little change over millennial timespans, but to what extent does industrial technology change this picture? And what about million-year timespans?

The only types of industrial civilisation we have observed so far have been that based on capitalist economics, and that based on socialism, in which a political ideology takes over the role of capital. Capitalist societies would seem to be expansionary in their very nature: they are defined by the self-multiplying power of capital. But could a socialist society, one with a suitable ideology which was sufficiently severely imposed, preserve zero growth indefinitely?

I think not, because societies evolve in an unpredictable manner. Governments which have tried to maintain control in, say, Tokugawa Japan (1603-1868) or Soviet Russia (1917-1989) have failed in their goals of stability (Japan) or planned growth (Russia), and modern liberal democracy works by limiting its ambitions and ceding much power to the economy at large. Even a global dictatorship, which unlike those two historical examples would by definition not face competition from abroad, would, I think, be unable to control all the disruptive political, technological and economic forces emerging unpredictably worldwide over centuries and millennia.

The result would then be either the breakout of a new phase of growth, or decline and collapse. In view of the likelihood of long-term adverse climate change (whether triggered by industrial pollution, or *asteroid* impact, or an outbreak of *super-vulcanism*, or the return of ice-age conditions, or solar variations), and in addition the persistent threat of global high-tech conflict (whether spreading destruction by nuclear weapons, or computer viruses, or genetically *engineered organism*s, or *microscopic* or macroscopic *robots*), decline would be the more plausible outcome.

Nevertheless, the question as to how long a global zero-growth industrial civilisation could survive in a stable state on one planet is an interesting one, though not one that is likely to attract unbiased analysis by modern sociology.

What, however, if growth is maintained? Surely Earth will become overburdened and that growth will lead to environmental and social collapse?

The point here is that, while the resources of Earth are limited, those of the Solar System are very much greater. Growth in population sizes and in the usage of energy and raw materials may therefore continue for a number of centuries into the future, provided that two conditions are met:

Material growth on Earth levels off;

Material growth in space and on other planets takes over the upward trend.

Is this not equivalent to saying that Earth must settle down with a zero-growth society before space development begins? No, so long as the terrestrial and extraterrestrial economies are linked. While this remains true, it will be possible for investors on Earth to invest capital in extraterrestrial development, and receive dividends back from that development. While most Earth-dwelling people will remain on the mother planet, there will also be flows of people, goods and ideas between Earth and her colonies, which must also have a profound economic effect.

A net inflow of value to Earth is in any case necessary in order that terrestrial investment in outer space does not merely produce inflation in the home economy. But that inflow need not be of material goods, and is more likely to consist of energy (solar power delivered on microwaves or lasers) and information (software and product development).

But surely ultimately the limits of the Solar System will be reached, and the interplanetary civilisation have to settle down as a zero-growth society? Yes, granted. But this differs from a zero-growth planet Earth due to the immense size of the Solar System, which is larger than Earth by between four and six orders of magnitude, depending how far out one wants to go – to the distance of Mars, say, or to the Oort comet cloud far beyond Pluto.

An interplanetary industrial civilisation is secure for the long term in a way that a monoplanetary one is not, because it is too large to form a unity, either politically or environmentally, and because it is forced to adapt to a wide range of hostile environmental conditions.

It will therefore be secure against *any conceivable* environmental or military *disaster*, because such a disaster can only affect a single planet, or at most a limited region of the system. Climate change or world war on Earth has no effect on Mars, and vice versa. And with the majority of the population in orbiting artificial space colonies, even a major change in solar luminosity could be tolerated (though such a change is not expected to have a noticeable effect for hundreds of millions of years yet).

With interplanetary civilisation, the social system as a whole can tolerate decline and collapse in particular locations, because they can then be recolonised from outside. Once humanity achieves interstellar status, this security factor is clearly vastly enhanced.

However, in order for interplanetary growth to occur in the first place, *an economic mechanism must be in place to drive it*. The most suitable economic mechanism that has been demonstrated so far is capitalism. Its *need for continuous expansion* makes it highly appropriate as an economic system for a society colonising its local planetary system.

It is not clear whether an economic system based on ideology could perform this function of capitalism. If the ideology was growth-oriented, then it would have no reason to conflict with the existing capitalist order, but would rather work in concert with it. But in the more plausible case that it was oriented towards social stability and economic stagnation, particularly in view of the environmentalist, anti-growth or anti-consumerist agendas it might very likely serve, then it would not want to promote disruptive new technologies such as those of access to space. The idea of a socially just socialist society (if such a hypothetical entity is possible) expanding into space is therefore a questionable one.