1AC Affirmative Case

Resolution

I affirm Resolved: The appropriation of outer space by private entities is unjust.

Definitions

First, defining key terms in the resolution:

"Appropriation" is defined by

Gorove 69, Stephen Gorove is Chairman of the Graduate Program of the School of Law and Professor of Law at University of Mississippi School of Law. Stephen Gorove, Interpreting Article II of the Outer Space Treaty, 37 Fordham L. Rev. 349 (1969). Available at: https://ir.lawnet.fordham.edu/flr/vol37/iss3/2

With respect to the concept of appropriation the basic question is what constitutes "appropriation," as used in the Treaty, especially in contradistinction to casual or temporary use. The term **"appropriation" is used** most frequently **to denote the taking of property for one's own or exclusive use** with a sense of permanence. Under such interpretation the establishment of a permanent settlement or the carrying out of commercial activities by nationals of a country on a celestial body may constitute national appropriation if the activities take place under the supreme authority (sovereignty) of the state. Short of this, if the state wields no exclusive authority or jurisdiction in relation to the area in question, the answer would seem to be in the negative, unless, the nationals also use their individual appropriations as cover-ups for their state's activities.5 In this connection, it should be emphasized that the word "appropriation" indicates a taking which involves something more than just a casual use. Thus a temporary occupation of a landing site or other area, just like the temporary or nonexclusive use of property, would not constitute appropriation. By the same token, **any use involving consumption** or taking **with intention of keeping for one's own** exclusive **use would amount to appropriation.**

"Outer Space" is 100km beyond Earth

Cooper 09, Nikhil D. Cooper is a J.D. Candidate of the University of California Berkeley, Hastings College of the Law, with a B.A. Rhetoric and Political Science. Cooper, Nikhil D. "Circumventing Non-Appropriation: Law and Development of United States" UC Hastings Law, Hastings Constitutional Law Quarterly, 1 Jan. 2009, https://repository.uchastings.edu/cgi/viewcontent.cgi?article=1845&context=hastings_constitutional_law_quaterly.

Scientists disagree as to exactly where territorial airspace ends and extraterritorial outer space begins.5 Regardless, most **scholars generally demarcate 100 to 110 kilometers above** Earth **sea level as the starting point of space.**6 For the space craft's occupants, hurtling past this boundary would signal numerous physical shifts, including, most famously, becoming weightless. However, less obvious is the legal shift that takes place once a craft crosses this boundary. Most notably, the where of the craft changes because the principle of **national sovereignty**, a defining feature of territorial air space law, **is absent once a craft crosses the airspace**/outer space **boundary**.7

"Private entities"

Law Insider No Date, "Private Entity Definition." Law Insider, https://www.lawinsider.com/dictionary/private-entity.

Private entity means any natural person, corporation, general partnership, limited liability company, limited partnership, joint venture, business trust, public benefit corporation, nonprofit entity, or other business entity.

"Unjust"

Dictionary.com No Date, "Unjust Definition & Meaning." Dictionary.com, https://www.dictionary.com/browse/unjust.

Unjust [uhn-juhst] not just; lacking in justice or fairness: unjust criticism; an unjust ruler.

Framework

Therefore, the value is justice, defined by giving each their due

Dictionary.com No Date, "Justice Definition & Meaning." Dictionary.com, https://www.dictionary.com/browse/justice.

the quality of being just; **righteousness,** equitableness, or moral rightness: to uphold the justice of a cause. rightfulness or lawfulness, as of a claim or title; justness of ground or reason: to complain with justice. the moral principle determining just conduct. **conformity to this principle, as manifested in conduct**; just conduct, dealing, or treatment:

Justice is achieved through the value criterion of maximizing human well-being, because only pleasure and pain are intrinsically valuable.

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

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

Contentions

Contention 1: Space Debris Collisions

Private companies overpopulate space with satellites, creating conditions for catastrophic debris collisions that are unmanageable

Daehnick and Harrington 21, Chris Daehnick is an associate partner in McKinsey's Denver office and leader of Radar, McKinsey's aerospace and defense market analytics platform. Jess Harrington is a solution associate in the Washington, DC, office. Daehnick, Chris, and Jess Harrington. "Look out below: What Will Happen to the Space Debris in Orbit?" McKinsey & Company, McKinsey & Company, 1 Oct. 2021, https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/look-out-below-what-will-happen-to-the-space-debris-in-orbit.

Space is having a moment. China launched the initial Tianhe module for its Tiangong space station this spring, and SpaceX followed shortly after with the first crewed mission from US soil since 2011. In July, Virgin Galactic and Blue Origin inaugurated suborbital tourist flights with their company leaders on board. Almost every week, it seems, **more private companies** and governments **announce new** concepts, flights, and projects. **The recent activity**, although exciting, **raises some concerns**. **The amount of space debris is growing**, despite requirements for satellite deorbit and disposal, **and** the problem **will soon escalate**. About **11,000 satellites have been launched in** the **64 years** since Sputnik 1 in 1957 (Exhibit 1). Exhibit 1 The amount of space debris is growing, despite requirements for satellite entry and deorbit. **Now we're at the point where about 70,000 satellites could enter orbit if proposed plans come to fruition**—an explosion of interest based on potential new markets, innovative architectures, and more sophisticated technologies (Exhibit 2). Even if all the proposed constellations fail to deploy, many more satellites will be in space. **Unless actively deorbited, they will remain there for months to hundreds of years**, depending on the altitude. Exhibit 2 Over 70,000 more satellites could soon enter orbit if plans come to fruition. We looked at space debris—what's been done so far, the growing risk, and the government response—to find some solutions. Beware of giant satellites—and floating paint chips Exactly what is **space debris**? Many people think this phrase **refers to** a gigantic hunk of metal about to crash into a major city, but only some of the **millions of objects in orbit** are as large as old upper-stage rockets and space stations. **Much** of the rest **consists of tiny particles, such as paint flecks.** The US Space Surveillance Network was tracking about 20,000 pieces of debris in orbit in 2019 (Exhibit 3).1 Today, there are about 27,000 pieces of debris,2 most of which are over ten centimeters in diameter. The trajectories of the rest—and what they might hit and when—are uncertain. Exhibit 3 In 2019, there were about 20,000 pieces of debris in orbit. The US Space Surveillance Network was tracking about 20,000 pieces of debris in orbit in 2019; today, there are about 27,000 pieces. The trajectories of the rest—and what they might hit and when—are uncertain. **Given the speed at which orbital objects move, even a collision between small debris and another object on a crossing trajectory can be catastrophic.** The International Space Station (ISS), which is designed to survive impacts by debris up to one centimeter in diameter, was damaged in May 2021 when an object about five millimeters in size punched a hole in the thermal covering of its robotic arm. The ISS, which has had to maneuver repeatedly to avoid larger debris, didn't suffer functional damage, but the incident reminded us that even major space systems are vulnerable to hits from tiny objects. Don't be surprised if reports of collisions increase over the next few years. **There is only about one tracked object for every 18 million cubic kilometers in low-Earth orbit**, but **this** number **doesn't include** potentially **lethal smaller debris, nor** does it account for **the relatively greater density of objects in certain orbits and the distance each object moves over any given time.** Both of those factors increase the chances of collision, even in a largely empty environment. **Space debris cannot be controlled** and may be in the skies for centuries, depending on the orbits and collision dynamics, **so the problem will remain**.3

Private company megaconstellations and satellites increase the chances of collision

Ramanathan 21, Kumutha Ramanathan is a Senior investing reporter for the Business Insider. Ramanathan, Kumutha. "Starlink's 'Megaconstellation' of 12,000 Satellites Could Account for 90% of near Misses in Orbit, Scientist Predicts." Business Insider, Business Insider, 19 Aug. 2021, https://www.businessinsider.com/starlink-will-ultimately-account-for-90-of-orbital-near-misses-2021-8.

Starlink satellites will ultimately be responsible for 90% of near misses in Earth orbit, a scientist predicts. Hugh Lewis told Space.com that Starlink satellites were already involved in about 50% of near misses. Near misses occur when two spacecraft pass within 1 kilometer (0.6 miles) of each other. See more stories on Insider's business page. Starlink satellites will ultimately be involved in 9 in 10 near misses between spacecraft that are orbiting Earth, a scientist and space debris expert has predicted. Once the "megaconstellation" of Starlink satellites has reached its intended size of **12,000**, it will be responsible for **90%** of these close encounters, research by Hugh Lewis, of the University of Southampton, published by Space.com, suggests. Starlink, which is owned by Elon Musk's SpaceX, aims to create "the world's most advanced broadband internet system." It has already launched around **1700** satellites into Earth orbit, which are responsible for about **half of all** near misses presently, Professor Lewis' research suggests. Near misses in Earth orbit occur when two spacecraft pass within 1 kilometer (0.6 miles) of each other. With a rapidly growing number of satellites being sent into orbit, scientists are concerned about the increased likelihood of collisions, and the potential for a chain reaction that leads to multiple collisions. Lewis examined data from the Satellite Orbital Conjunction Reports Assessing Threatening Encounters in Space (Socrates) database, which tracks satellite orbits and models their trajectory to assess collision risk. He looked at data back to May 2019, when Starlink launched its first batch of satellites. Lewis said that Starlink satellites were responsible for 1,600 close encounters between two spacecraft a week. Excluding near misses involving two Starlink satellites, the figure was 500, he said. He told Space.com that the number of encounters picked up by the Socrates database "has more than doubled and now we are in a situation where Starlink accounts for half of all encounters." OneWeb, a Starlink competitor, has 250 satellites in orbit, which are [is] involved in 80 near misses with other operators' satellites each week.

Collisions cascade, creating more debris which creates an endless cycle of increasing collision

Les **Johnson 13**, Deputy Manager for NASA's Advanced Concepts Office at the Marshall Space Flight Center, Co-Investigator for the JAXA T-Rex Space Tether Experiment and PI of NASA's ProSEDS Experiment, Master's Degree in Physics from Vanderbilt University, Popular Science Writer, and NASA Technologist, Frequent Contributor to the Journal of the British Interplanetary Sodety and Member of the American Institute of Aeronautics and Astronautics, National Space Society, the World Future Society, and MENSA, Sky Alert!: When Satellites Fail, p. 9-12 [language modified]

Whatever the initial cause, the result may be the same. A **sat**ellite destroyed in orbit will break apart into **thousands of pieces**, each traveling at over 8 km/sec. This virtual shotgun blast, with pellets traveling 20 times faster than a bullet, will quickly spread out, with each pellet now following its own orbit around the Earth. With over 300,000 other pieces of junk already there, the tipping point is crossed and a runaway series of collisions **begins**. A few orbits later, two of the new debris pieces strike other satellites, causing them to explode into thousands more pieces of debris. The rate of collisions increases, now with more spacecraft being destroyed. Called the "Kessler Effect", after the NASA scientist who first warned of its dangers, these debris objects, now numbering in the millions, cascade around the Earth, destroying every **sat**ellite in **l**ow **E**arth **o**rbit. Without an atmosphere to slow them down, thus allowing debris pieces to bum up, most debris (perhaps numbering in the millions) will remain in space for hundreds or thousands of years. Any new satellite will be threatened by destruction as soon as it enters space, effectively rendering many Earth orbits **unusable**.

Russian early warning satellites are unreliable today – nuclear war is possible in minutes if the early warning to detect missiles is disrupted

Graham 05, Thomas Graham, Jr. is a former special representative of the president for arms control, nonproliferation, and disarmament, participating in every major arms control and nonproliferation negotiation that the United States took part from 1970 to 1997. Graham, T. (2005, December). Space Weapons and the Risk of Accidental Nuclear War. Arms Control Association. Retrieved August 17, 2022, from https://www.armscontrol.org/act/2005-12/features/space-weapons-risk-accidental-nuclear-war#bio

The United States and Russia maintain thousands of nuclear warheads on long-range ballistic missiles on 15-minute alert. **Once launched**, they cannot be recalled, and **they will strike** their targets **in** roughly **30 minutes**. Fifteen years after the end of the Cold War, the chance of an accidental nuclear exchange has far from decreased. Yet, the United States may be contemplating further exacerbating this threat by deploying missile interceptors in space. Both **the United States and Russia rely on space-based systems to provide early warning of a nuclear attack**. If deployed, however, U.S. **space-based missile defense interceptors could eliminate** the Russian **early warning satellites quickly and**

without warning. So, just the existence of U.S. space weapons could make Russia's strategic trigger fingers itchy. The potential protection space-based defenses might offer the United States is swamped therefore by their potential cost: a failure of or false signal from a component of the Russian early warning system could lead to a disastrous reaction and accidental nuclear war. There is no conceivable missile defense, space-based or not, that would offer protection in the event that the Russian nuclear arsenal was launched at the United States. Nor are the Russians or other countries likely to stand still and watch the United States construct space-based defenses. These states are likely to respond by developing advanced anti-satellite weapon systems.[1] These weapons, in turn, would endanger U.S. early warning systems, impair valuable U.S. weapons intelligence efforts, and increase the jitteriness of U.S. officials. The Dangers of Failed Early Warning Systems The Russian early warning system is in serious disrepair. This system consists of older radar systems nearing the end of their operational life and just three functioning satellites, although the Russian military has plans to deploy more. The United States has 15 such satellites. Ten years ago, on January 25, 1995, this aging early warning network picked up a rocket launch from Norway. The Russian military could not determine the nature of the missile or its destination. Fearing that it might be a submarine-launched missile aimed at Moscow with the purpose of decapitating the Russian command and control structure, the Russian military alerted President Boris Yeltsin, his defense minister, and the chief of the general staff. They immediately opened an emergency teleconference to determine whether they needed to order Russia's strategic forces to launch a counterattack. The rocket that had been launched was actually an atmospheric sounding rocket conducting scientific observations of the aurora borealis. Norway had notified Russia of this launch several weeks earlier, but the message had not reached the relevant sections of the military. In little more than two minutes before the deadline to order nuclear retaliation, the Russians realized their mistake and stood down their strategic forces. Thus, 10 years ago, when the declining Russian early warning system was stronger than today, it read this single small missile test launch as a U.S. nuclear missile attack on Russia. The alarm went up the Russian chain of command all the way to the top. The briefcase containing the nuclear missile launch codes was brought to Yeltsin as he was told of the attack. Fortunately, Yeltsin and the Russian leadership made the correct decision that day and directed the Russian strategic nuclear forces to stand down. Obviously, nothing should be done in any way further to diminish the reliability of the space-based components of U.S. and Russian ballistic missile early warning systems. A decline in confidence in such early warning systems caused by the deployment of weapons in space would enhance the risk of an accidental nuclear weapons attack. Yet, as part of its plans for missile defense, the Pentagon is calling for the development of a test bed for space-based interceptors as well as examining a number of other exotic space weapons. In an interview published in Arms Control Today, Lt. Gen. Henry Obering, director of the Missile Defense Agency, touted what he said was "a very modest and moderate test-bed approach to launch some experiments." Obering said the Pentagon would only deploy a handful of interceptors: "We are talking about onesies, twosies in terms of experimentation."[2]

Debris could be mistaken as an attack on Russian early-warning satellites, triggering global nuclear conflict

Barrett 16, Anthony M. Barrett is cofounder and director of research of the Global Catastrophic Risk Institute and senior risk analyst at ABS Consulting. Barrett, Anthony, False Alarms, True Dangers? Current and Future Risks of Inadvertent U.S.-Russian Nuclear War. Santa Monica, CA: RAND Corporation, 2016. https://www.rand.org/pubs/perspectives/PE191.html.

What Might a Future Early Warning False Alarm Look Like? This scenario could take place over the next three years: Falling oil and gas prices make it difficult for Russia to maintain its early warning system components. One of the northern-facing Russian radars begins failing some of its reliability tests, and a month later the Russian early warning satellite constellation loses its only geostationary satellite. A combination of technical problems and budget pressures prevent either a radar overhaul or a launch of a replacement satellite for at least a year. Two months after the geostationary satellite loss, one of several remaining Russian early warning satellites in a highly elliptical Molniya orbit detects flares of some kind in the area of the ICBM fields in the northern United States. At that moment, the satellite is the only component of the Russian early warning satellite constellation that is in an orbital position allowing it to see the northern United States. The satellite cannot immediately determine whether the flares are due to launches at ICBM bases or to something else, such as fires at oil or gas facilities in the same region, or perhaps the reflection of sunlight off high-altitude clouds. The satellite is able to transmit its flare-detection signal to other parts of the Russian early warning system, alerting system operators in Russia. However, the Russian satellite is then struck by orbital debris, and it instantly ceases communication with Russian early warning system operators. **Russian early warning system operators must quickly decide** what to tell their leaders. Did the satellite detect a launch of **U.S. ICBMs?** Was the loss of communications capabilities caused by **sabotage?** Could Russian radar systems rule out the possibility of incoming ICBMs? These questions could be quite serious during a period of seeming calm between the United States and Russia, but they would be especially urgent during a period of heightened tension or crisis. This Perspective represents the various pathways for a false alarm scenario for both nations in one fault tree (Figure 1), given the assumption that both Russia and the United States have similar procedures to respond to early warning alarms and use roughly analogous categories of low-, mid-, and high-level alarm events. **The outcome** of concern here, of course, **is the launch of nuclear missiles when one country mistakenly concludes that it is under attack by the other**. As shown in the second level of the tree, **a launch in response to a false alarm could occur either during a** U.S.-Russian **crisis or** during a **period of low tension**. The next layer in the tree shows that a launch in response to a false alarm could occur if a midlevel false alarm is promoted to a high level and involves senior national leadership who choose a launch response. Each of those steps in the decision process for false alarms has an associated node in the fault tree that is a key risk factor in the model. That all applies to both crisis and noncrisis periods. However, as is shown farther down the tree, during crisis conditions, the effective total rate of false alarms includes both midlevel false alarm events and any low-level events whose resolution (identification as a false alarm) cannot be completed before the "use them or lose them" point where a launch response decision needs to be made by leaders.1 Two key risk factors in the early warning false alarm scenario are whether there is a perceived crisis at any point in time and how likely Russia would be to assume either a launch-on-warning or launch-under-attack posture. Both postures rely on launching missiles in response to a perceived attack once attack indicators are provided and before the perceived attack is expected to affect or disable command and communications capabilities (that is, neither posture relies on "riding out" an attack before launching a counter-attack). The primary difference between the two postures is in the level of evidence required to pass the signal detection threshold for an attack indication (at which point "decision time" begins), as well as the amount of time required to obtain that level of evidence. Some **Russia**n analysts have argued that it **is** better for Russia to be **able to launch its weapons on warning of a U.S. attack rather than in a responsive second strike** (Quinlivan and Oliker, 2011, p. 25). **This** would ensure the deterrent value of Russian nuclear forces, despite the possibility that Russian forces would not survive a disarming first strike. Similar arguments led to the original development and potential use of launch-on-warning postures by the United States and the USSR during the Cold War. All else equal, **a launch-on-warning posture generally has a higher potential for false indications of attack than a launch-under-attack posture, which requires more early warning information** (from a larger number of independent sensor systems).

Even a small nuclear war leads to decreased quality of life and extinction of humankind

Witze 20, Alexandra Witze writes for Nature from Boulder, Colorado. Witze, Alexandra. "How a Small Nuclear War Would Transform the Entire Planet." Nature News, Nature Publishing Group, 16 Mar. 2020, https://www.nature.com/articles/d41586-020-00794-y.

The goal was to analyse every step of nuclear winter — from the initial firestorm and the spread of its smoke, to agricultural and economic impacts. "We put all those pieces together for the first time," says Robock. The group looked at several scenarios. Those range from a **US–Russia war** involving much of the world's nuclear arsenal, which would **loft 150 million tonnes of soot** into the atmosphere, down to the 100-warhead India–Pakistan conflict, which would generate 5 million tonnes of soot6. The soot turns out to be a key factor in how bad a nuclear winter would get; three years after the bombs explode, Global temperatures would have **plummeted by more than 10 °C** in the first scenario — more than the cooling during the last ice age — but by a little more than 1 °C in the second. Toon, Robock and their colleagues have used observations from major wildfires in British Columbia, Canada, in 2017 to estimate how high smoke from burning cities would rise into the atmosphere7. During the wildfires, sunlight heated the smoke and caused it to soar higher, and persist in the atmosphere longer, than scientists might otherwise expect. The same phenomenon might happen after a nuclear war, Robock says. Raymond Jeanloz, a geophysicist and nuclear-weapons policy expert at the University of California, Berkeley, says that incorporating such estimates is a crucial step to understanding what would happen during a nuclear winter. "This is a great way of cross-checking the models," he says. Comparisons with giant wildfires could also help in resolving a controversy about the scale of the potential impacts. A team at Los Alamos National Laboratory in New Mexico argues that Robock's group has overestimated how much soot burning cities would produce and how high the smoke would go8. The Los Alamos group used its own models to simulate the climate impact of India and Pakistan setting off 100 Hiroshima-sized bombs. The scientists found that much less smoke would get into the upper atmosphere than Toon and Robock reported. With less soot to darken the skies, the Los Alamos team calculated a much milder change to the climate — and no nuclear winter. Pakistani spectators watch the Shaheen II long-range missile capable of carrying a nuclear warhead on its launcher at a parade. At a 2005 parade in Islamabad, Pakistan, a truck carries a Shaheen II long-range missile that can be armed with a nuclear warhead.Credit: Farooq Naeem/AFP via Getty The difference between the groups boils down to how they simulate the amount of fuel a firestorm consumes and how that fuel is converted into smoke. "After a nuclear weapon goes off, things are extremely complex," says Jon Reisner, a physicist who leads the Los Alamos team. "We have the ability to model the source and we also understand the combustion process. I think we have a better feel about how much soot can potentially get produced." Reisner is now also studying the Canadian wildfires, to see how well his models reproduce how much smoke gets into the atmosphere from an incinerating forest. Robock and his colleagues have fired back in tit-for-tat journal responses9. Among other things, they say the Los Alamos team simulated burning of greener spaces rather than a densely populated city. Dark seas While that debate rages, Robock's group has published results showing a wide variety of impacts from nuclear blasts. That includes looking at ocean impacts, the first time this has been done, says team member Nicole Lovenduski, an oceanographer at the University of Colorado Boulder. When Toon first approached her to work on the project, she says, "I thought, 'this sure seems like a bleak topic'." But she was intrigued by how the research might unfold. She usually studies how oceans change in a gradually warming world, not the rapid cooling in a nuclear winter. Lovenduski and her colleagues used a leading climate model to test the US–Russia war scenario. "It's the hammer case, in which you hammer the entire Earth system," she says. In one to two years after the nuclear war, she found, Global cooling **[This] would affect the oceans' ability to absorb carbon**, causing their pH to skyrocket. That's the opposite to what is happening today, as the oceans soak up atmospheric carbon dioxide and waters become more acidic. She also studied what would happen to aragonite, a mineral in seawater that marine organisms need to build shells around themselves. In two to five years after the nuclear conflict, the cold dark oceans would start to contain less aragonite, putting the organisms at risk, the team has reported2. In the simulations, some of the biggest changes in aragonite happened in regions that are home to coral reefs, such as the southwestern Pacific Ocean and the Caribbean Sea. That suggests that coral-reef ecosystems, which are already under stress from warming and acidifying waters, could be particularly hard-hit during a nuclear winter. "These are changes in the ocean system that nobody really considered before," says Lovenduski. And those aren't the only ocean effects. Within a few years of a nuclear war, a "Nuclear Niño" would roil the Pacific Ocean, says Joshua Coupe, a graduate student at Rutgers. This is a turbo-charged version of the phenomenon known as El Niño. In the case of a US–Russia nuclear war, the dark skies would cause the trade winds to reverse direction and water to pool in the eastern Pacific Ocean. As during an El Niño, **Droughts and heavy rains** could plague many parts of the world for as long as seven years, Coupe reported last December at a meeting of the American Geophysical Union. Beyond the oceans, the research team has found big impacts on land crops and food supplies. Jonas Jägermeyr, a food-security researcher at NASA's Goddard Institute for Space Studies in New York City, used six leading crop models to assess how agriculture would respond to nuclear winter. Even the relatively small India–Pakistan war would have catastrophic effects on the rest of the world, he and his colleagues report this week in the Proceedings of the National Academy of Sciences1. Over the course of five years, maize (corn) production would drop by 13%, wheat production by 11% and soya-bean production by 17% . The worst impact would come in the mid-latitudes, including breadbasket areas such as the US Midwest and Ukraine. **Grain reserves would be gone** in a year or two. Most countries would be unable to import food from other regions because they, too, would be experiencing crop failures, Jägermeyr says. It is the most detailed look ever at how the aftermath of a nuclear war would affect food supplies, he says. The researchers did not explicitly calculate how many people would starve, but say that The ensuing famine would be worse than any in documented history. Farmers might respond by planting maize, wheat and soya beans in parts of the globe likely to be less affected by a nuclear winter, says Deepak Ray, a food-security researcher at the University of Minnesota in St Paul. Such changes might help to buffer the food shock — but only partly. The bottom line remains that a war involving less than 1% of the world's nuclear arsenal could shatter the planet's food supplies.

Contention 2: Rocket Launch Pollution

Private company space initiatives are taking off and will only increase from here

Ben-Itzhak 22, Svetla Ben-Itzhak is assistant professor of space and international relations at the U.S. Air and Space Forces' Air University. Ben-Itzhak, Svetla. "Analysis | Companies Are Commercializing Outer Space. Do Government Programs Still Matter?" The Washington Post, WP Company, 11 Jan. 2022, https://www.washingtonpost.com/politics/2022/01/11/companies-are-commercializing-outer-space-do-government-programs-still-matter/.

Over the last 15 years, commercial activity in space more than tripled, growing from $110 billion in 2005 **to nearly $357 billion in 2020**. **Commercial activity in 2020 accounted for about 80 percent of the** estimated **$447 billion global space economy** that year. Morgan Stanley projects that the sector will rocket to more than $1 trillion by 2040, **with growth concentrated in the commercial space sector.** The modern idea of space travel is rooted in private aspirations, dating back to scientists and engineers such as Robert Goddard, Herman Oberth, Konstantin Tsiolkovsky and Robert Esnault-Pelterie, all considered among the founding fathers of modern rocketry and astronautics. When space exploration proved possible, governments monopolized space activities throughout the 1950s to 1970s. Commercial space operations kicked off in 1962 with the launch of the first transatlantic communication satellite, Telstar 1. In the United States, the Communications Satellite Act of 1962 affirmed the right of private companies to own and operate commercial satellites. Other major milestones include the Commercial Space Launch Act in 1984, a more independent U.S. Office of Commercial Space Transportation and the 2015 US SPACE Act aimed at encouraging the commercial exploration and exploitation of space. This **gradual deregulation in the United States resulted in tremendous growth of commercial space initiatives**. The first privately funded rocket, the Conestoga, was launched in 1982 by Space Services. In 2004, the first private, suborbital human spaceflight took place on board SpaceShipOne. In 2012, SpaceX, a private company, began transporting cargo to and from the International Space Station. And in 2020, SpaceX flew American astronauts from U.S. soil for the first time since 2011, when NASA's space shuttle missions ended. Commercial space ventures picked up in 2021 Commercial ventures in space made global headlines last year when SpaceX flew two additional space station missions: Crew-2 and Crew-3, and launched Inspiration4, the first all-civilian mission to orbit Earth. Virgin Galactic launched two suborbital human spaceflights from Spaceport America, and Blue Origin conducted two spaceflights close to the 62-mile Kármán line, demarcating the beginning of outer space (Jeff Bezos, Blue Origin's founder, owns The Washington Post). **Virgin Galactic and Blue Origin announced** additional **spaceflights, while SpaceX is preparing to go to the moon, [and] Mars** and beyond. NASA partnered with Blue Origin, Nanoracks and Northrop Grumman to develop commercial destinations in low-earth orbit. Bigelow, Nanoracks and Axiom Space are designing human habitats in space; **Maxar and Northrop Grumman are working on the future Gateway lunar space station, Orbital Assembly plans to open the first space hotel in 2027**, and Japan's Obayashi Corp. aims to create a space elevator by 2050.

Space companies contribute to climate change through rocket launches and the mass-emission of greenhouse gasses

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Marais and a team of researchers from University College London (UCL), the University of Cambridge and Massachusetts Institute of Technology (MIT) used a 3D model to explore **the impact on the atmosphere of rocket launches and re-entry** in 2019, and the future impact of space tourism **promoted by companies** like Virgin Galactic and Blue Origin. Marais's team found that **black carbon emissions will** more than **double after just an additional three years of [private company] space tourism launches**, and that **particles emitted by rockets are** almost **500 times more efficient at holding heat in the atmosphere than all other sources of soot combined, resulting in an enhanced warming climate effect**. While current loss of ozone due to space launches is small, **the impact of space tourism launches may undermine the recovery in the ozone layer** experienced after the success of the 1987 Montreal Protocol which banned substances that deplete the Earth's ozone layer. When you have the cumulative effect of more launches, it is going to get interesting – Dimitris Drikakis Maloney and his team **calculated that each year rocket launches that use RP-1 collectively expel around 1 gigagram, or 1,000** metric tons, of black carbon into the stratosphere. Thanks to the growing number of rockets launched, **this could reach 10 gigagrams a year in a couple of decades**, **along with a temperature [will] rise in parts of the stratosphere of as much as 1.5 degrees Celsius, and a thinning of the ozone layer.** If the amount of black carbon expelled into the atmosphere reach 30 gigagrams a year, or even 100, then there will be some cooling of the surface of the planet under this black carbon umbrella. For their research paper, Ioannis Kokkinakis and Dimitris Drikakis, scientists at the University of Nicosia in Cyprus, used real rocket launch data from a Space X Falcon 9 rocket in 2016 to create the "first high-resolution and high-order computational model" of its kind to analyse in detail the impact of rocket emissions on the climate. This Space X launch was chosen because useful webcam footage of the exhaust gases was available. One of the "biggest surprises" they found is that **in the first stage of the rocket launch** around **116 tons of CO2 was emitted in 165 seconds.** "That is quite significant," says Drikakis. "Yes, we don't know the actual impact on the atmosphere because atmospheric chemistry is a very complicated matter, but when you have the cumulative effect of more launches, it is going to get interesting." Orbex plan to launch rockets up to 12 times a year (Credit: Orbex) Orbex plan to launch rockets up to 12 times a year (Credit: Orbex) Another discovery was that nitrogen oxides were formed from the heating of the atmospheric air by the hot rocket exhaust gases, and their impact at lower altitudes seems to depend on the design of the rocket nozzles. "This is important because rocket design can potentially mitigate this effect," Drikakis says. Every model makes assumptions for efficiency and due to the complex nature of the Earth's atmosphere, and then undergoes rigorous validation. "If they're all converging on a single story, then you can have fairly good confidence that they are on to something," says Maloney. Now there is a race on to develop alternatives to existing fuels like RP-1 and UDMH, and liquid methane appears to be in the lead. Several new rocket engines, including SpaceX's Raptor and the European Space Agency's Prometheus engine, have been designed to use this gas as a fuel because it has a higher performance than other fuels, meaning the rocket can be smaller and produce less soot when it's launched. Its lower cost means the price of a rocket launch can be reduced, too. Several **rocket start-ups are** at a relatively early stage of experimenting with sustainable alternatives to RP-1 made from waste plastic or biomass Methane, however, is controversial because it is one of the worst gases [for] as far as global warming is concerned. It is around 80 times more warming than carbon dioxide over its lifetime.

The impact of is climate change and the extinction of humankind – the timeframe is soon

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Life on this planet has gone through many extinction-level events over time. Most of these phenomena were caused by natural, cataclysmic forces beyond the control of any of the lifeforms existing at that time. The current cataclysmic forces are anything but natural and they are well within our control. The question is not, "will global warming cause extinction?"— it's, "how can we prevent that inevitability from happening?" Will global warming cause extinction? Eventually, yes. **Global warming will invariably result in the mass extinction of millions of different species, humankind included.** In fact, the Center for Biological Diversity says that **global warming is currently the greatest threat to life on this planet.** Global warming causes a number of detrimental effects on the environment that many species won't be able to handle long-term. **Extreme weather patterns are** shifting climates across the globe, **eliminating habitats and altering the landscape**. As a result, **food and fresh water sources are being drastically reduced**. Then, of course, **there are the rising global temperatures** themselves, **which many species are physically unable to contend with**. Formerly frozen arctic and antarctic regions are melting, increasing sea levels and temperatures. Eventually, these effects will create a perfect storm of extinction conditions. What species will go extinct if global warming continues? The melting glaciers of the arctic and the searing, unmanageable heat indexes being seen along the Equator are just the tip of the iceberg, so to speak. The species that live in these climate zones have already been affected by the changes caused by global warming. Take polar bears for example, whose habitats and food sources have been so greatly diminished that they have been forced to range further and further south. **Increased carbon dioxide levels in the atmosphere and oceans have** already **led to ocean acidification**. This has caused many species of crustaceans to either adapt or perish and has led to the mass bleaching of more than 50 percent of Australia's Great Barrier Reef, according to National Geographic. According to the Center for Biological Diversity, the current trajectory of global warming predicts that **more than 30 percent of Earth's plant and animal species will face extinction by 2050. By the end of the century,** that number could be as high as **70 percent**. Will global warming cause humanity's extinction? We won't try and sugarcoat things, **humanity**'s own prospects aren't looking that great either. According to The Conversation, our species **has just under a decade left** to get our CO_2 emissions under control. **If we don't cut** those **emissions by half before 2030, temperatures will rise to** potentially **catastrophic levels.** It may only seem like a degree or so, but the worldwide ramifications are immense. The human species is resilient. We will survive for a while longer, even if these grim global warming predictions come to pass, but **it will mean less food,** less **water,** and **increased hardship** across the world — **especially in low-income areas and developing countries**. This increase will also mean **more pandemics,** devastating **storms, and** uncontrollable **wildfires.** It's difficult to calculate the numbers in these cases or to assess precisely what risks we will all be facing, but this is because we have never experienced anything like it before.