Jan/Feb Aff Case

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

My value for today's round is justice.

My criterion is the reduction of inequality against women.

a. Violence against women is de-prioritized in the debate space when teams rush towards accessing high magnitude impacts without realizing the effect they have one women first. Debates about extinction without acknowledging the gender disparities they cause create environments where impacts concerning women are rarely addressed. Vote aff. to promote better diversity and education.

Contention 1: Space Junk

Corporate New Space enterprises will increase the traffic in LEO and strain debris mitigation strategies

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

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

providers are developing lower-cost approaches to space launch and typically **operate on tighter margins** and **with fewer resources than traditional launch providers, which limits** both **familiarity** with **and ease of implementing debris mitigation practices**.

Growing commercialization of space activities by private entities is causing satellite numbers to triple— thus increases the risk of space debris

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

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

Cascading debris collapses satellites.

Kessler et al., 18 [Donald J. Kessler* American astrophysicist and former NASA scientist known for his studies regarding space debris. Kessler has received numerous awards for his pioneering work, the most recent being the 2010 Dirk Brower Award for his half-century career in astrodynamics. Dr. Holder Krag** Head of the Space Debris Office at the European Space Agency and has been a Space Debris Analyst in the Space Debris Office since 2006. Asher Isbrucker***, Writer & Video Producer; 11-2-2018; "Kessler Syndrome: What Happens When Satellites Collide," Medium, https://asherkaye.medium.com/kessler-syndrome-what-happens-when-satellites-collide-1b571ca3c47e] brett

Donald Kessler: The worst case scenario is that you end up creating enough debris that it's not cost-effective to depend on space. Now, that may take a long time, but because **it's a non-reversible process, once you've reached a certain threshold where you're generating debris from these collisions faster than it can be cleaned** out, it'll just continually get worse unless you can do something drastic. Holger Krag: If we continue operating the way we do today, we will have a disaster in 50

years, in 100 years. It compares quite nicely to the CO2 issue, and the climate on ground, so it's not our generation suffering from all the CO2 released into the atmosphere, it is **future generations**, but it is **our generation** that **has to take** the **action**. And the space debris problem is quite similar. DK: My name's Don Kessler, I worked for NASA till 1996 as the senior researcher for orbital debris. I started the program back in 1979, and the program is still very active today. In the 1960s my main job was to define the interplanetary meteoroid environment. At the time, the only space debris NASA had to be concerned about were meteoroids, many of which are generated from collisions in the asteroid belt. These asteroid collisions are a cascading phenomenon, meaning every collision creates more ammunition for future collisions. It's a positive feedback loop. Don was studying this phenomenon when he started to consider an interesting question: DK: When will the same phenomenon start happening in the Earth's orbit? When will this same kind of cascading occur with satellites? And it was just a matter of curiosity as to what that number may be, and actually when I did the calculations, I was really shocked at the answer that it would happen so soon. Don published a paper in 1978 proposing this scenario, predicting that we'd start to see satellite collisions in Earth orbit by the year 2000. Just like in the asteroid belt, these satellite collisions would trigger a domino effect: creating a whole bunch of debris which **causes more collisions**, creating more debris, and so on. His main point: **once the process starts, it'll be nearly impossible to stop**. This self-perpetuating phenomenon, this domino effect, beca me known as Kessler Syndrome. The first accidental collision occurred in 1996, when a French satellite was struck by a piece of a rocket thruster that had exploded ten years earlier, severing its stabilization boom and, for the first time, demonstrating how entangled the orbital environment has become. HK: In 2009 a collision happened that was by far more dramatic. The event he's referring to was the first collision between two intact satellites: the Russian satellite Kosmos and an American Iridium. And that was the first catastrophic accidental collision that got everybody's attention because not only did they realize how much debris is generated when something like that occurs but that **we are now entering this phase of what we're calling the Kessler Syndrome**. Just two years earlier the Chinese military conducted a controversial anti-satellite test, intercepting one of their own defunct weather satellites with a kinetic kill vehicle — a non-explosive missile which relies on sheer speed of impact to destroy its target. It blew the satellite to smithereens and created just a huge mess, it was really bad. DK: And unfortunately it was something they should have known not to do. Yeah, that's because the US did the same thing back in 1985 — the first anti-satellite test, with more or less the same results. DK: We at NASA tried to delay that or stop that because, we said it's going to create enough debris that we'll have to add more shielding to the space station which was planned to be launched a few years later. And nobody believed it would make that much debris, but it did. All of these collisions, accidental or otherwise, make a big mess of junk zipping around the Earth called space debris. It accounts for 95% of the objects in Low Earth orbit, and comes in all shapes and sizes. It's technically defined as any nonfunctional object in orbit, so there's big stuff like rocket thrusters and defunct satellites, but the vast majority are little bits and pieces called fragmentation debris. Many of these fragments come from explosions caused by residual fuel and other explosive energy sources self-igniting under the extreme conditions of space. These explosions happen more often than you might think, and as catastrophic and messy as these explosions are, collisions are even worse due to the incredible amount of kinetic energy involved. At the velocities objects travel in Lower Earth Orbit (speeds known as hypervelocity) even an object as tiny as a screw can deliver an incapacitating strike to a satellite. In fact, NASA has repeatedly had to replace shuttle windows due to hypervelocity impacts by flecks of paint. HK: These are velocities, we have no example nor anything that compares to that on ground. So the energy involved in these collisions is extremely high. A 1 cm object that size like a cherry hitting a satellite with 10 km/s, the energy released by this corresponds roughly to an exploding grenade. You can imagine what the satellite looks like after that. DK: Yes, let me know show you something. This is something that was shot in the lab, it's a projectile about the size of a BB, and it makes a crater into, this is solid aluminum, and this was only going about 5 km/s, about half the speed of what you would expect in space. **Most of this is happening in L**ow **E**arth **O**rbit, the 2000 km strip of space above our heads **where we've packed the** vast **majority of** our **satellites**, **including the I**nternational **S**pace **S**tation and the Hubble Space Telescope. The most crowded section is between 500 and 1000 km up. It's the densest region, it's the Highway 401 of space. DK: And that's what's creating the problem because we've crowded so much stuff in that small region. And the probability of collision goes as the square of the spatial density. So you double the number of satellites, you get four times as many collisions. Now, the space station usually flies around 300 km but the debris that's generated at that higher altitude is being thrown down and drifting down to the lower altitudes. HK: If you look at the space station surface you will find craters everywhere, impact craters caused by debris everywhere. Whenever you bring hardware down and inspect it on ground you find craters of all sizes. What do we do with this? How do you protect the life of the astronauts? The only thing you can do is shielding. And to protect against a hypervelocity impact you need a special type of lightweight shielding, called Whipple shielding. DK: Let me show you something else. The same particle that caused this kind of damage [image below, left] only caused this kind of damage [image below, right]on a surface with a very minor amount of shielding on it. And that's, it's almost a liquid splattered onto that. Most spacecraft utilize this type of shielding, which can withstand impacts from objects up to about one centimeter. Objects larger than a softball are catalogued and tracked by the US Space

Surveillance Network. Tracking **is imprecise**, but allows spacecraft to dodge some of the debris that comes too close. This **only works for objects larger than 10 cm or so. Anything smaller can't be reliably tracked.** For that reason, the most concerning objects are those between 1 and 10 cm; too large for shielding to withstand and too small to be tracked. **These objects could incapacitate any spacecraft in their path, or worse**. And **with every future explosion and collision there will be more and more of these invisible projectiles going around.** The problem gets worse when you consider how long objects can remain in orbit. Depending on altitude, debris in Low Earth Orbit may remain there for years, decades, or centuries before their orbit naturally decays enough to re-enter the Earth's atmosphere. For example, look no further than ENVISAT; a defunct 8-tonne satellite operated by the European Space Agency until it lost contact in 2012, becoming a massive piece of space junk in the densest region of Earth orbit. ENVISAT will remain in orbit for 200 years if not removed. Experts hope to avoid an encore of ENVISAT and to mitigate Kessler Syndrome through the international adoption of two clean space policies. The first will prevent explosions by requiring so-called passivation of onboard energy sources. HK: Meaning, residual fuel must be either depleted, burned, released through a valve, whatever. That's number one: no more explosions. DK: And the other is what we call a 25 year rule. Once you put something in orbit, after you finish using it you have 25 years to get it out. Either by moving up to a designated "graveyard orbit" where it will pose minimal risk to active spacecraft or more ideally, lowering its altitude so it will burn up in the atmosphere sooner. These policies aren't difficult to follow and are beginning to be adopted internationally. HK: When we do these two things that would already make space flight pretty safe for the future. It would mean, if we do this systematically, the risk in the future would be almost the same as it is today. The mitigation measures they help to dampen the effect of the Kessler Syndrome, we are not talking about stopping it, we are talking about maintaining it on an acceptable level, the growth. But it will grow, even if we implement these two measures strictly. If we want to even prevent this growth, then we need to do active removal. DK: We've already concluded that it's going to take something like removing 500 intact objects over the next 100 years in order to stabilize the Low Earth Orbit environment again.

That works out to five objects per year for the next century, which at least seems achievable, right? The challenge though is that there's no easy way to remove space debris. HK: We need to approach the object that are not under control anymore, and attach to them, dock with them, rendezvous them, capture them somehow, and then get rid of them in a controlled way. You can imagine this is not so easy. Experts are working on ways to remove debris, and there are several promising ideas in early development. There are reusable concepts like tethers and space tugs which can grab multiple objects per launch, which saves money. There are ground- or space-based lasers which can deorbit objects by kind of shooting them down, but these face political challenges. There are actually active satellites in space right now, the University of Surrey is controlling a spacecraft called RemoveDEBRIS which will use a harpoon to grab on to debris, that's promising. And there's another single-use option like ESA's e.Deorbit, currently planned to retrieve and deorbit ENVISAT in 2023. Many of these ideas aren't scalable, though, that's the problem, they're expensive and complicated, and missions like these are almost completely unprecedented. The pressure is on, though, because Kessler Syndrome isn't waiting, and the consequences for space infrastructure are dire. HK: Today only half of the satellites actually disappear from space within the 25 years that are recommended as the maximum on orbit time. We still have five explosions every year. If we continue and not improve the way we do spaceflight, **then in a few decades** some regions of **space might not be useable** anymore for spaceflight, or it might be much too risky to go there. And that might mean that we either lose services from space that we rely on today, or they get more expensive. AI: Do you think something like Kessler Syndrome is inevitable? Are you optimistic that this can be managed properly, or do you think this is an inevitable issue for a spacefaring society? HK: I think it can be managed, it can be managed. I do believe **it's time** for young people **to take charge** and there's a lot of work to be done, and there's enough people involved today that I'm confident that it's going to be done. Much like other environmental and generational problems, Kessler Syndrome is invisible to us. When you look up at the night sky, you don't see collisions and explosions and fragments of debris. If you're lucky and the conditions are right, you might see one white speck drifting across the sky, a tiny testament to humankind's highest collective ambitions. **But that speck is at risk, along with all it represents, if we don't address this invisible problem — because Kessler Syndrome isn't waiting.**

The modern food system relies on satellites. Collapse triggers global shocks to supply.

Tompkins 19 [Steven, Inmarsat's Director of Sector Development for Agriculture. Head of Resilient and Sustainable Supply Chains Team at ADAS. Entrepreneurial manager with a sustained track record of building new profitable business streams for science-based organizations in the agri-food sector.; 3-18-2019; "Enabling the connected farm – the importance of satellite communications," Inmarsat, https://www.inmarsat.com/blog/enabling-the-connected-farm-the-importance-of-satellite-communications/] brett

The Agri-Tech Revolution, Agriculture 4.0, the smart and connected farm. There is no shortage of buzzwords hinting at a digitalised future, or solutions being touted as game-changing for the global agricultural industry. Commonly claimed benefits include **increasing crop yields**, and **a reduction in input**

costs and the reliance on manual labour. Many of these solutions rely on reliable internet connectivity in the field to push data from one place to another, but there are still vast swathes of agricultural land that suffer from unreliable or non-existent connectivity, either lacking cellular or broadband connectivity. If we are to take advantage of the huge possibilities available to us, overcoming our connectivity challenges will be crucial. **This is where satellite communications can help**. When I tell people that I am an agriculturalist working for a satellite company, almost always the response is related to an experience of using space imagery (known as Earth Observation) to help automate processes such as crop scouting. But there is another breed of satellites that don't produce images but do provide fast and reliable internet and voice communications across the world in areas that cellular and fibre connectivity cannot reach. Ubiquitous connectivity from **satellites opens up** huge **possibilities for farmers in remote areas to take advantage of** the **Agri-Tech** Revolution. In some cases, this is as simple as connecting frontline worker teams in large plantations to operations centres to prioritise workload and create efficiencies. Taking it one step further, **satellite communications** can be a **bridge** to enable **farmers to connect data** producing devices **in the field (such as weather stations, sensors, data from farm machinery) to business applications.** Known by the tech world as the 'Internet of Things' or IoT, this **approach collects data from the field and harnesses it to support intelligent decision-making**. For instance: obtaining real-time data on nutrient status in the field from NPK (Nitrogen Phosphorous and Potassium) sensors, alongside crop monitoring data and hyper-local weather that would allow you to **make completely objective risk-based decisions on when and where to apply fertiliser.** We know the industry is taking this proposition seriously – our own research told us that on average agriculture respondents expect to spend close to $1million on IoT solutions in the next three years and 72% of respondents would use satellite technology to support their projects. Of course, satellite isn't the answer to everything and should be used in tandem with other connectivity types, and the good news is it's easy to integrate with other connectivity technologies. With increasing demand to connect the physical world to the digital world, in some of the world's remotest locations think of satellite not just as a series of images taken from space but an enabler to the Agri-Tech Revolution.

Global shocks lead to food insecurity. Food insecurity leads to poverty, which threatens global security, meaning I control all impacts in the round.

Trudell, JD Candidate at Syracuse University College of Law, **2005.**
Robert Trudell, JD Candidate at Syracuse University College of Law, Fall 2005. [Food security emergencies and the power of eminent domain: a domestic legal tool to treat a global problem, Syracuse Journal of International law and Commerce, Accessed at: Lexis Nexus]

Food security deserves its place in any long-term calculation regarding global security. **Widespread chronic hunger causes widespread instability and debilitating poverty and decreases all of our safety**, for example from the increased threat from global terrorism. n58 Widespread instability is an unmistakable characteristic of life in sub-Saharan Africa. n59 Food insecurity, therefore, causes global insecurity because widespread instability in places like sub-Saharan Africa threatens all of our safety. **Food insecurity in the unstable regions of the world must be taken on now lest we find ourselves facing some far worse danger in the days to come.**

On-going violence outweighs, and should be given first prioritization.

Richard **Jackson,** Deputy Director of the National Centre for Peace and Conflict Studies at the University of Otago, New Zealand, and former professor of international politics of Abrerystwyth University, Wales, "Richardjacksonterrorismblog," August 5, **2012**. [The great con of national security, last accessed on March 28, 2020, Accessed at: https://richardjacksonterrorismblog.wordpress.com/2012/08/05/the-great-con-of-national-security/] MD

It may have once been the case that being attacked by another country was a major threat to the lives of ordinary people. It may also be true that there are still some pretty serious dangers out there associated with the spread of nuclear weapons. For the most part, however, **most of what you've been told about** national security and all **the big threats** which can supposedly kill you **is one big con designed to distract you from the things that can really hurt you,** such as the poverty, inequality and structural violence of capitalism, global warming, and the manufacture and proliferation of weapons – among others. The facts are simple and irrefutable: you're far more likely to die from lack of health care provision than you are from terrorism; from stress and overwork than Iranian or North Korean nuclear missiles; from lack of road safety than from illegal immigrants; from mental illness and suicide than from computer hackers; from domestic violence than from asylum seekers; from the misuse of legal medicines and alcohol abuse than from international drug lords. And yet, politicians and the servile media spend most of their time talking about the threats posed by terrorism, immigration, asylum seekers, the international drug trade, the nuclear programmes of Iran and North Korea, computer hackers, animal rights activism, the threat of China, and a host of other issues which are all about as equally unlikely to affect the health and well-being of you and your family. Along with this obsessive and perennial discussion of so-called 'national security issues', **the state spends** truly **vast sums on security measures which have virtually no impact on the actual risk of dying from these threats**, and then engages in massive displays of 'security theatre' designed to show just how seriously the state takes these threats – such as the x-ray machines and security measures in every public building, surveillance cameras everywhere, missile launchers in urban areas, drones in Afghanistan, armed police in airports, and a thousand other things. This display is meant to convince you that these threats are really, really serious. And while all this is going on, the rulers of society are hoping that you won't notice that increasing social and economic inequality in society leads to increased ill health for a growing underclass; that suicide and crime always rise when unemployment rises; that workplaces remain highly dangerous and kill and maim hundreds of people per year; that there are preventable diseases which plague the poorer sections of society; that domestic violence kills and injures thousands of women and children annually; and that globally, poverty and preventable disease kills tens of millions of people needlessly every year. In other words, **they are hoping that you won't notice how much structural violence there is in the world**. More than this, **they are hoping that you won't notice that** while literally **trillions of dollars are spent on military weapons, foreign wars and security** theatre (which also arguably **do nothing to make any us any safer,** and may even make us marginally less safe), that domestic violence programmes struggle to provide even minimal support for women and children at risk of serious harm from their partners; that underfunded mental health programmes mean long waiting lists to receive basic care for at-risk individuals; that drug and alcohol rehabilitation programmes lack the funding to match the demand for help; that welfare measures aimed at reducing inequality have been inadequate for decades; that health and safety measures at many workplaces remain insufficiently resourced; and that measures to tackle global warming and developing alternative energy remain hopelessly inadequate. Of course, none of this is surprising. Politicians are a part of the system; they don't want to change it. For them, all the insecurity, death and ill-health caused by capitalist inequality are a price worth paying to keep the basic social structures as they are. A more egalitarian society based on equality, solidarity, and other non-materialist values would not suit their interests, or the special interests of the lobby groups they are indebted to. It is also true that dealing with economic and social inequality, improving public health, changing international structures of inequality, restructuring the military-industrial complex, and making the necessary economic and political changes to deal with global warming will be extremely difficult and will require long-term commitment and determination. For politicians looking towards the next election, it is clearly much easier to paint immigrants as a threat to social order or pontificate about the ongoing danger of terrorists. It is also more exciting for the media than stories about how poor people and people of colour are discriminated against and suffer worse health as a consequence. Viewed from this vantage point, **national security is one massive** confidence trick – **misdirection** on an epic scale**. Its**

primary function is to distract you from the structures and inequalities in society which are the real threat to the health and wellbeing of you and your family, and **to convince you to be permanently afraid** so that you will acquiesce to all the security measures which keep you under state control and keep the military-industrial complex ticking along. Keep this in mind next time you hear a politician talking about the threat of uncontrolled immigration, the risk posed by asylum seekers or the threat of Iran, or the need to expand counter-terrorism powers. The question is: when politicians are talking about national security, what is that they don't want you to think and talk about? What exactly is the misdirection they are engaged in? **The truth is**, if you think that terrorists or immigrants or asylum seekers or Iran are a greater threat to your safety than the capitalist system, **you have been well and truly conned,** my friend. Don't believe the hype: **you're much more likely to die from** any one of several forms of **structural violence** in society than you are from immigrants or terrorism. Somehow, we need to challenge the politicians on this fact.

Specifically, women will be the first to experience the effects of food shortages, and in the most severe cases.

United Nations Entity for Gender Equality and the Empowerment of Women **(UN Women),** branch of UN**, No date given**

https://www.unwomen.org/en/news/in-focus/women-and-the-sdgs/sdg-2-zero-hunger

Hunger has a woman's face. In nearly two-thirds of countries, women are more likely than men to report food insecurity. The world's worst food insecurity is in sub-Saharan Africa, affecting half the population. Yet, 10 per cent of women in the United Kingdom also cannot count on having enough nutritious food, a share slightly higher than for men. Women and girls prepare most of the world's household meals and grow much of its food. **Globally, almost one third of employed women work in agriculture, not accounting for self-employed and unpaid family workers.** Yet, only 13 per cent women are landholders. In some parts of the world, such as South Asia and sub Saharan Africa, more than 60 per cent of all working women are working in agriculture, concentrated informal and poorly paid jobs with little or no social protection. Not having equal access to land or credit, technology and markets leaves many on the margins of subsistence agriculture**. When times are tough, gender discrimination means women and girls may be the first to eat less, even as they work harder to secure food for their households.**

Finally, violence and discrimination increase during times of crisis. Women's health is disproportionately put at risk.

Merckel, Kathryn, PhD student, International Nutrition, Cornell University, **2016**

https://www.worldhunger.org/women-and-hunger-facts/

In severe **crises, particularly those in which families are separated or displaced, the consequences on the health and nutrition of women and their children can be dire. Access to an inadequate diet while fleeing war or while in a refugee camp worsens deficiencies a woman already has. Pregnant or lactating women** are extremely vulnerable in these situations. They **lack access to proper nutrition advice and medical care.** Stress can cause preterm deliveries, which is much more likely to take place without a skilled assistant or in a sanitary environment. Women are more vulnerable socially and economically to malnutrition. **56% of maternal and child deaths take place in fragile settings.** Fragile settings are regions affected by violent conflict or natural disasters.

Contention 2 : Global warming

Commercial Space Industry requires an enormous increase in launches – that causes pollutants and warming.

Gammon 21 Katharine Gammon 7-19-2021 "How the billionaire space race could be one giant leap for pollution" https://www.theguardian.com/science/2021/jul/19/billionaires-space-tourism-environment-emissions (I'm an award-winning independent science journalist based in Santa Monica, California. My interests range from culture and nature in public lands to the lives of scientists to the complexity of baby brains. Before I became a professional journalist, I served in the Peace Corps in Bulgaria, and attended MIT and Princeton University.)//Elmer

Last week Virgin Galactic took Richard Branson past the edge of space, roughly 86 km up – part of **a new space race** with the Amazon **billionaire Jeff Bezos,** who aims to make a similar journey on Tuesday. Both very wealthy businessmen **hope to vastly expand the number of people in space.** "We're here to **make space more accessible** to all," said Branson, shortly after his flight. "Welcome to the dawn of a new space age." Already, people are buying tickets to space. Companies including SpaceX, Virgin Galactic and Space Adventures want to make space tourism more common. The Japanese billionaire Yusaku Maezawa spent an undisclosed sum of money with SpaceX in 2018 for a possible future private trip around the moon and back. And this June, an anonymous space lover paid $28m to fly on Blue Origin's New Shepard with Bezos – though later backed out due to a "scheduling conflict". **But this launch of a new private space industry** that is cultivating tourism and popular use **could come with vast environmental costs**, says Eloise Marais, an associate professor of physical geography at University College London. Marais studies the impact of fuels and industries on the atmosphere. **When rockets launch into space, they require** a **huge amount of propellants** to make it out of the Earth's atmosphere. For SpaceX's Falcon 9 rocket, it is **kerosene**, **and** for Nasa it is **liquid hydrogen** in their new Space Launch System. Those fuels **emit** a variety of substances into the atmosphere, including **carbon dioxide,** water, chlorine and other chemicals. The carbon emissions from rockets are small compared with the aircraft industry, she says. But they are **increasing at nearly 5.6% a year**, and Marais has been running a simulation for a decade, to figure out at what point will they compete with traditional sources we are familiar with. "For one long-haul plane flight it's one to three tons of carbon dioxide [per passenger]," says Marais. For one rocket launch 200-300 tonnes of carbon dioxide are split between 4 or so passengers, according to Marais. "So it doesn't need to grow that much more to compete with other sources." **Right now, the number** of rocket flights **is very small**: in the whole of 2020, for instance, there were **114 attempted** orbital launches in the world, according to Nasa. That compares with the airline industry's more than 100,000 flights each day on average. But **emissions** from rockets are **emitted right into the upper atmosphere, which means they stay there for a long time**: two to three years. Even water injected into the upper atmosphere – where it can form clouds – **haveing warming impacts**, says Marais. "Even something as seemingly innocuous as water can have an impact." Closer to the ground, all **fuels emit** huge amounts of **heat**, **which can add ozone to the troposphere**, where it acts like a greenhouse gas and retains heat. In addition to carbon dioxide, fuels like kerosene and methane also produce soot. And in the upper atmosphere, the ozone layer can be destroyed by the combination of elements from burning fuels. "While **there are a number of environmental impacts resulting from the launch of space vehicles, the depletion of stratospheric ozone is the most studied and most immediately concerning**," wrote Jessica Dallas, a senior policy adviser at the New Zealand Space Agency, in an analysis of research on space launch emissions published last year.

Another report from 2019 penned by the Center for Space Policy and Strategy likened the space emissions problem to that of space debris, which the authors say creates an existential risk to the industry. "Today, launch vehicle emissions present a distinctive echo of the space debris problem. Rocket engine exhaust emitted into the stratosphere during ascent to orbit adversely impacts the global atmosphere," they wrote. "We just don't know how large the space tourism industry could become," says Marais. A new market report estimates that the global suborbital transportation and space tourism market is estimated to reach $2.58bn in 2031, growing 17.15% each year of the next decade. "The **major driving factor** for the market's robustness will be focused efforts to enable **space transportation**, **emerging startups in suborbital transportation**, and **increasing developments in low-cost launching sites,"** the report says. In the past, most space transportation has been focused on cargo supply missions to the International Space Station and satellite launch services, but currently, this focus has shifted to in-space transportation, planetary explorations, crewed missions, suborbital transportation and space tourism. Several companies, including SpaceX, Blue Origin and Virgin Galactic, have been focusing on developing platforms such as rocket-powered suborbital vehicles that will enable the industry to carry out suborbital transportation and space tourism. People have pointed out that the money these billionaires have poured into space technology could be invested in making life better on our planet, where wildfires, heatwaves and other climate disasters are becoming more frequent as the globe warms up in the climate crisis. "Is anyone else alarmed that billionaires are having their own private space race while record-breaking heatwaves are sparking a 'fire-breathing dragon of clouds' and cooking sea creatures to death in their shells?" the former US Labor Secretary Robert Reich tweeted last week. Marais says that there is always an element of excitement to new developments in space – but it's still possible to be responsible while doing something exciting. She urges caution as the space tourism industry grows, and says there are currently no international rules around the kinds of fuels used and their impact on the environment. "We have no regulations currently around rocket emissions," she says. "The time to act is now – while the billionaires are still buying their tickets."

Commercialization increases Space travel to where it specifically hurts the Ozone Layer.

Marais 21 Eloise Marais 7-19-2021 "Space tourism: rockets emit 100 times more CO_2 per passenger than flights – imagine a whole industry" https://theconversation.com/space-tourism-rockets-emit-100-times-more-co-per-passenger-than-flights-imagine-a-whole-industry-164601 (Associate Professor in Physical Geography, UCL)//Elmer

The **commercial race** to get tourists **to space is heating up** between Virgin Group founder Sir Richard Branson and former Amazon CEO Jeff Bezos. On Sunday 11 July, Branson ascended 80 km to reach the edge of space in his piloted Virgin Galactic VSS Unity spaceplane. Bezos' autonomous Blue Origin rocket is due to launch on July 20, coinciding with the anniversary of the Apollo 11 Moon landing. Though Bezos loses to Branson in time, he is set to reach higher altitudes (about 120 km). The launch will demonstrate his offering to very wealthy tourists: the opportunity to truly reach outer space. Both tour packages will provide passengers with a brief ten-minute frolic in zero gravity and glimpses of Earth from space. Not to be outdone, Elon Musk's SpaceX will provide four to five days of orbital travel with its Crew Dragon capsule later in 2021. What are the environmental consequences of a space tourism industry likely to be? Bezos boasts his Blue Origin rockets are greener than Branson's VSS Unity. The Blue Engine 3 (BE-3) will launch Bezos, his brother and two guests into space using liquid hydrogen and liquid oxygen propellants. VSS Unity used a hybrid propellant comprised of a solid carbon-based fuel, hydroxyl-terminated polybutadiene (HTPB), and a liquid oxidant, nitrous oxide (laughing gas). The SpaceX Falcon series of reusable rockets will propel the Crew Dragon into orbit using liquid kerosene and liquid oxygen. **Burning** these **propellants** provides the energy needed to launch rockets into space while also **generating greenhouse gases and air pollutants. Large quantities of water vapour** are produced by burning the BE-3 propellant, while combustion of both the VSS Unity and Falcon fuels **produces** CO_2, **soot** and some water vapour. The nitrogen-based oxidant used by VSS Unity also **generates nitrogen oxides**, compounds **that contribute to air pollution** closer to Earth. Roughly two-thirds of the propellant exhaust is released into the stratosphere (12 km-50 km) and mesosphere (50 km-85 km), where it can persist for at least two to three years. The very high temperatures during launch and re-entry (when the protective heat shields of the returning crafts burn up) also convert stable nitrogen in the air into reactive nitrogen oxides. **These gases and particles have many negative effects on the atmosphere**. In the stratosphere, nitrogen oxides and chemicals formed from the breakdown of water vapour convert ozone into oxygen, **depleting the ozone layer which guards life on Earth against**

harmful UV radiation. Water vapour also produces stratospheric clouds that provide a surface for this reaction to occur at a faster pace than it otherwise would. Space tourism and climate change **Exhaust emissions** of CO_2 and soot **trap heat** in the atmosphere, **contributing to global warming.** Cooling of the atmosphere can also occur, as clouds formed from the emitted water vapour reflect incoming sunlight back to space. **A depleted ozone layer would also absorb less incoming sunlight**, and so heat the stratosphere less. Figuring out the overall effect of rocket launches on the atmosphere will require detailed modelling, in order to account for these complex processes and the persistence of these pollutants in the upper atmosphere. Equally important is a clear understanding of how the space tourism industry will develop. Virgin Galactic anticipates it will offer 400 spaceflights each year to the privileged few who can afford them. Blue Origin and SpaceX have yet to announce their plans. But globally, **rocket launches wouldn't need to increase by much from the current 100** or so performed each year **to induce harmful effects that are competitive with other sources**, like ozone-depleting chlorofluorocarbons (CFCs), and CO_2 from aircraft. During launch, rockets can emit between four and ten times more nitrogen oxides than Drax, the largest thermal power plant in the UK, over the same period. CO_2 emissions for the four or so tourists on a space flight will be between 50 and 100 times more than the one to three tonnes per passenger on a long-haul flight. In order for international regulators to keep up with this nascent industry and control its pollution properly, scientists need a better understanding of the effect these billionaire astronauts will have on our planet's atmosphere

Women are most affected by climate change.

McCarthy, Joe, Global Citizen, **20**
https://www.globalcitizen.org/en/content/how-climate-change-affects-women/

Climate change is a planetary phenomenon that will impact all countries, but its effects are being **shaped by** pervasive and entrenched **gender inequality. Heat waves, droughts, rising sea levels, and extreme storms disproportionately affect women.** That's because **women are more likely to live in poverty than men, have less access to basic human rights like the ability to freely move and acquire land, and face systematic violence that escalates during periods of instability.** These factors, and many more, mean that **as climate change intensifies, women will struggle the most**. In fact, the Paris climate agreement includes specific provisions to ensure women receive support to cope with the hazards of climate change.

Climate change is killing 250,000 people a year who are disproportionately women, and will double in twenty-five years.

Christensen, reporter for CNN, **19.**
Jen Christensen, "CNN", January 16, 2019. [250,000 deaths a year from climate change is a 'conservative estimate,' research says, last accessed on February 13, 2022, Accessed at: https://www.cnn.com/2019/01/16/health/climate-change-health-emergency-study/index.html] MD

Climate change could "halt and reverse" progress made in human health over the last century. The grim analysis comes from one of the authors of **a new report in the New England Journal of Medicine** that **suggests rising global temperatures could lead to many more deaths than the 250,000 a year the World Health Organization predicted just five years ago**. In reviewing the research on the topic, study co-author Sir Andrew Haines thinks our health is much more vulnerable to climate change – and he believes 250,000 deaths is a "conservative estimate." "We

think the impact is more difficult to quantify because there is also population displacement and a range of additional factors like food production and crop yield, and the increase in heat that will limit labor productivity from farmers in tropical regions that wasn't taken into account among other factors," **said Haines, a British epidemiologist and former director of the London School of Hygiene & Tropical Medicine.** Due to climate change-related food shortages alone, **the world could see a net increase of 529,000 adult deaths by 2050,** the report said. Climate change could force 100 million people into extreme poverty by 2030 and poverty makes peorple more vulnerable to health problems. In 2014 the WHO said that **climate change will bring with it** malaria, diarrhea, **heat stress and malnutrition,** killing that many more people annually around the world from 2030 to 2050.

Additionally, private entities guarantee continued patriarchy because they further increase inequalities, it also makes getting access to power harder to address the problems.

UN Climate Change, No date given.

UN Climate Change, "Introduction to Gender and Climate Change," no date given. [last accessed on February 13, 2022, Accessed at: https://unfccc.int/gender] MD

Climate change has a greater impact on those sections of the population, in all countries, that are most reliant on natural resources for their livelihoods and/or who have the least capacity to respond to natural hazards, such as droughts, landslides, floods and hurricanes. Women commonly face higher risks and greater burdens from the impacts of climate change in situations of poverty, and the majority of the world's poor are women. **Women's unequal participation in decision-making processes and labour markets compound inequalities and often prevent women from fully contributing to climate-related planning, policy-making and implementation.**

On case

Non-unique- Cost

No solvency- The cost of mining means that we will never see minerals brought back from space.

Fickling is a Bloomberg Opinion columnist covering commodities, as well as industrial and consumer companies, **2020.**

David Fickling, LiveMint, December 22, 2020. [We earthlings are never going to asteroids for minerals, last accessed on January 5, 2022, Accessed at: https://www-livemint-com.cdn.ampproject.org/v/s/www.livemint.com/opinion/columns/we-earthlings-are-never-going-to-mine-asteroids-for-minerals/amp-11608650916882.html?amp_gsa=1&amp_js_v=a6&usqp=mq331AQIKAGwASCAAgM%3D&fbclid=IwAR1ZkCVF9CyPfcmxFvY8S1VLdWFnnSOJm-TnDWxlL8WYeCK52DgNTG9EmRE] MD

One factor rules out most **space mining** at the outset: **gravity**. On one hand, it guarantees that most of the solar system's best mineral resources are to be found under our feet. Earth is the largest rocky planet orbiting the sun. As a result, the cornucopia of minerals the globe attracted as it coalesced is as rich as will be found this side of Alpha Centauri. **Gravity poses a technical problem**, too. **Escaping Earth**'s gravitational field makes transporting the volumes of material needed in a mining operation **hugely expensive**. On *Falcon Heavy,* the large rocket being developed by Elon Musk's SpaceX, transporting a payload to the orbit of Mars comes to as little as $5,357 per kilogram, a drastic reduction in normal launch costs. Still, at those prices just lofting **a single** half-tonne **drilling rig** to the asteroid belt **would use up the annual exploration budget of a small mining firm. Power is another issue**. The international space station, with 35,000 sq ft of solar arrays, generates up to 120 kilowatts of electricity. **That drill would need a** similar-sized **power plant. Power demands rise sharply once you move from exploration drilling to mining and processing. Bringing material back to Earth would raise the costs even more**. Japan's Hayabusa2 satellite spent six years and 16.4 billion yen ($157 million) recovering a single gram of material from the asteroid Ryugu.