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Space Expansionism: A Pre-Disaster Legacy in the Making

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Abstract

It has been well documented that the impacts and force of European colonialism were built upon the subjugation of Indigenous people and their lands, the consequences of which are both long-enduring and devastating. Yet the same logics and discourse continue to be employed around the potential benefits of space expansionism – both economic and military – and contribute to the rationale offered to justify the conquest of outer space. Space expansionism relies on imperial claims over resources, involves activities that subjugate marginalized peoples, contributes to the growing climate catastrophe and exacerbates existing inequalities where spacefaring countries – the most powerful states on Earth – are engaged in efforts to not only consolidate power but to emerge as the dominant military and economic force, often at the expense of local and/or Indigenous populations. Here, drawing from post-colonial studies and politics of exclusion, we examine the inherent harms to the colonial mission of the space industry as a capitalist-colonial project and demonstrate how the same colonial logics of old are being used to justify state and private expansionism into space.

Keywords: Space expansionism; colonialism; space race; exclusion; harm.

Introduction

It has been well documented that the impacts and force of European colonialism were built upon the subjugation of Indigenous peoples and their lands, the consequences of which are both long-enduring and devastating (Aganaba et al., 2025; Dunn, 2025; Rothe & Collins, 2025b). Couched in rationalizations that focused on conquest, pioneerism, freedom and enterprise (Landers, 1961) in the name of "economic and social renewal of the mother country through new commodities, trades and territory" (McCormick, 2021) – what Redfield (2002) calls "the language of empire" (p. 792) – the harms caused were rationalized through the propagation of these logics.

We argue that modern space colonialism, which includes space exploration/expansionism and colonization, its logics, justifications and ensuing projects, is grounded in the same discourse, rationalizations and practices of the previous couple of centuries of colonial imperialism and colonialism. On their face, the logics of fifteenth-, sixteenth- and seventeenth-century colonial projects may appear structurally and/or ideologically different from colonialism in terms of current space expansionism logics and rationalizations. For example, some might call for a deviation in colonial logics premised on nuances that provincialize and localize spatial and temporal differences, or to differentiate between today's space colonialism and "old" colonialism, especially as it relates to the assumption that one is a state enterprise and the other involves private industry. However, the "logics of capitalism, colonialism, and corporations have always been [and continue to be] intimately, and

violently, intertwined" (Utrata, 2021). It is important to note that private industry was an integral part of empire-building and colonialism, from the British Empire's connection to the East India Company, to the dominance of the Dutch West India Company, to the British South Africa Company, to those operating in extractive colonies prevalent during the 1800s, to mention but a few, companies were an integral part of empire-building and colonialism (Rothe & Collins, 2025b; Stern, 2023). Likewise, to differentiate space expansionism as being primarily a corporate enterprise minimizes, and therefore ignores, how it has been embraced and heavily funded by state actors. Examples include the United States' mission for a complete cis-lunar economy, their *Artemis* missions, DARPA's *10-year Lunar Architecture Capability Study* (Garofalo, 2023), and their goals for a moon-based railroad network (see Rothe & Collins, 2025b).

Let us return to definitional or conceptual understandings of colonialism, which is defined in various ways, including the "direct physical occupation of a territory originally inhabited by other human groups" (Goyes, 2023, p. 10). Or more broadly conceptualized as a nation that extends control over another domain or area (Council on Foreign Relations, 2023) and settles its people on the "conquered" territory (Kohn & Reddy, 2024). Generally, colonialism is understood to be "a form of domination – the control by individuals of groups over the territory and/or behavior of individuals or groups" (Horvath, 1972, p. 46). Other definitions expand this to include capitalist-colonialism and economic domination, while still others – including those that focus on the extraction of resources – prioritize cultural domination. Central to all definitions, however, is *power* (Landers, 1961).

Others frame space expansionism logics as coloniality – meaning the existence of ideas, attitudes and narratives that persist and sustain colonial power hierarchies (Cotterell & Grant, 2025). We would be remiss if we did not recognize that some invoke the term "postcolonialism" in terms of literature and identity (Dhirubhai, 2023; Kortenaar, 2011) or in terms of examining its impact on the social and cultural (including identity and knowledge production) and effects on former colonized territories (Mishra & Hodge, 2005; Young, 2016). While these terms are often used interchangeably, post-colonialism focuses on the period after the end of colonial rule, critiquing the effects on societies and people in former colonized regions (Upadhayaya, 2023).

Also relevant to our argument is settler colonialism, which focuses on the permanent existence of colonists on land (Veracini, 2013; Wolfe, 2006), and it emphasizes the importance of space,[1] as in this case it is dependent on controlling the land and space it has colonized for its sustainment. Without it, the settler colony fails. However, settler colonialism comes at the expense of Indigenous peoples, and with its success indigeneity is eradicated. This includes the destruction of previous ecosystems and physical changes to the environment to "shape the environment into something familiar" to colonizers (Fraser, 2023). One need only recall how the United States was "built upon the brutal subjugation of Indigenous people and Indigenous lands … the American settler state proceeded upon a project of cultural and physical genocide" (Smiles, 2020). The linkages between settler colonialism and outer space might appear weak, yet this argument ignores how select elites have long utilized outer space as a source of state or imperial power (for more details, see Klinger, 2021).[2]

Consider the rhetoric and arguments for colonizing or terraforming Mars "to make it fit for human habitation", which "is born of the priorities of settler colonialism" (Fraser, 2023). Space was and remains a place to be conquered and instrumentalized to serve strategic national interests, territorial control and superiority. For example, in 2021 the Adam Smith Institute, a lobbying and think tank-based organization in the United Kingdom, published a report advocating for the privatization of the Moon. More specifically, it argued that the Moon should be divided into plots of land, allocated to specific countries so they could rent them to businesses for exploration, discovery and tourism (Horvat, 2022); this is reminiscent of the Berlin West Africa Conference (1885), where Western powers (France, Germany, Great Britain, Portugal and King Leopold II of Belgium) carved out ownership of Africa among themselves (Lawal, 2025).

Just as then, space expansionism continues to rely on imperial claims[3] over resources, involves activities that subjugate marginalized peoples (Sammler & Lynch, 2021), contributes to the growing climate catastrophe (Rubenstein, 2022) and exacerbates existing inequalities where spacefaring countries, the most powerful states on Earth, are engaged in efforts to not only consolidate power but to emerge as the dominant military and economic power. Moreover, consider that through private capital and a monopoly on the space industry, space expansionists – including billionaires, states and private corporations – have leaned into imperialist rhetoric to express and justify the need to dominate outer space. Stephen Hawking has expressly called for the colonization of space to ensure species survival (Chow, 2017), while Jeff Bezos of Blue Origin and Elon Musk of SpaceX have publicly spoken about creating human habitats off-planet. During Jeff Bezos's speech at the 2021 Ignatus Forum, he shared his vision for an off-planet habitat, describing them as "floating habitats that mimic Earth's weather and gravitational pull. The floating, spinning cylinders would be able to hold as many as 1 million people and have 'rivers and forests and wildlife'" (Hartmans, 2021). However, as we have argued elsewhere, what is often neglected in this rhetoric of utopian societies or the privatization of outer space resources (i.e., moons, planets and asteroids) is the prioritization of state

and private capital accumulation as well as military dominance, not to mention the costs and harms to humanity and other living species, and Earth's environment, that occur in pursuit of these endeavours (Rothe & Collins, 2023).

History is not left in the past as it contributes to the current space industry's focus on claiming and appropriating space resources (i.e. mining, water, space, planets) and territorial control and superiority, not to mention the appropriation of Earth-based resources in pursuit of space expansionism and colonialism that have disastrous impacts for Indigenous communities (Fraser, 2023) – such as the ongoing tensions over the Thirty Meter Telescope on Mauna Kea in Hawaii (Witze, 2020). Through this lens, space-related infrastructures become projects of state power, often through companies/corporations and elite billionaires, as well as development and displacement in the settler colonial context (Mitchell, 2018; Redfield, 2002). We argue that, just as colonialism manifested historically, through our examination of modernity (Redfield, 2002) the term remains the best descriptor of today's race to space and space colonization. After all, we continue to see colonial practices of enclosures of lands, extending "dominance into new 'frontiers' of control, racism and erasure of other forms of [non-Western] knowledge" (Cotterell & Grant, 2025), exploitation of the environment and its resources, negative impacts on and erasure of Indigenous voices and rights and territory grabs (Aganaba et al., 2025) and "the destruction of landscapes – in the name of ideals such as destiny, civilization, and the salvation of humanity" (Rubenstein, 2022). We argue that the impact of colonial logics, language and projects of empire remains the same as it was centuries ago, as those advocating for space colonialism are enthusiastic in their imperialism, arguing for conquests, settlement and expansionism, eagerly utilizing the word "colony". As stated by Adam Fish, "you can see a direct line between historical colonialism and the practices of modern space exploration … the language used – planting flags, claiming territory, resource extraction – is reminiscent of the colonial playbook" (Quoted in Dunn, 2025).

Having provided a brief overview of colonialism and its logics, we draw from post-colonial studies, settler colonialism and the politics of exclusion (Cooper & Stoler, 1997; Rodriguez & Huizer, 2019; Stoler, 1992) to examine the inherent harms of the colonial mission of the space industry as a capitalist-colonial project. Our approach is also informed by the growing criminological literature on the violence and harms caused by the space industry (Bohlander, 2021; Lampkin, 2021; Lampkin & McClanahan, 2024; Lampkin & White, 2023; Rothe & Collins, 2023, 2025a, 2025b), termed "astro-criminology" by some (Lampkin, 2021), as well as contributions from green criminology including examinations of environmental harm caused by the space industry (Beirne & South, 2013; Brisman & South, 2019, 2020; Burns & Lampkin, 2024; Lampkin & Wyatt, 2023; Lynch & Stretesky, 2014; Takemura, 2019). However, we recognize the limitations of adopting an approach that is solely dependent on criminological scholarship. Focusing on the exigent harm here on Earth, we take a zemiological approach to examine the harm caused by space expansionism that is justified through colonial logics. Moving beyond intentional harms and legalistic definitions common to criminological inquiry (Hillyard & Tombs, 2007), our focus is structural, environmental and social.

We now turn our attention to the pervasive colonial rhetoric around space colonialism, followed by case studies such as the Thirty Meter Telescope on Mauna Kea in Hawaii and Guiana Space Center in Koura in French Guiana, to illustrate that the space industry is dependent on the same colonial logics and practices of displacement, resource extraction, and exploitation, resulting in environmental and community harm to indigenous populations.

Space, Colonialism and Colonial Rhetoric

> *Holden:* I got your covered wagon reference. I grew up in Montana, you know. That frontier shit is still the story the people there tell about themselves.
>
> *Fred:* So you know that the mythology of manifest destiny hides a lot of tragedy. Many of those covered wagons never made it. And more than a few of the people who did wound up as cheap labor for the railroads, mines, and rich farmers. (Corey, 2015, p. 14)

The link between outer space and colonial history has been normalized in the saturation of frontier metaphors, as seen in the above epigraph from a popular science fiction book and television series, *The Expanse*, to speeches on manifest destiny, speculations on human expansion and more. Consider that words such as "pioneer," "conquest," "settlers," "destiny," "frontier" and "exploitation" frequently make it into official and political discourse to justify state power. This is evident in the following examples from United States presidents, dating back to John F. Kennedy's 1962 address at Rice University in Houston, where he stated: "What was once the furthest outpost on the old frontier of the West will be the furthest outpost on the new frontier of science and space" (Kennedy, 1962). In addition, the Reagan-appointed National Commission on Space (1986) titled its final report on the long-term goals of the United States civilian space exploration "Pioneering the Space Frontier," which included its "pioneering mission for 21st-century America: to lead the exploration and development of the space frontier." Similarly, President George F. W. Bush's administration deemed that the primary objective of the United States space program was "to

open the space frontier" (National Space Council, 1990). President George W. Bush also drew on manifest destiny and frontierism during his speech at NASA Headquarters (2004) titled, Pioneering Vision for Space Exploration when he stated:

> Two centuries ago, Meriwether Lewis and William Clark left St. Louis to explore the new lands acquired in the Louisiana Purchase. They made that journey in the spirit of discovery, to learn the potential of vast new territory, and to chart a way for others to follow. America has ventured forth into space for the same reasons. (Bush & NASA, 2004)

Additionally, during President Donald Trump's 2020 State of the Union Address to Congress, he said:

> In reaffirming our heritage as a free nation, we must always remember that America has always been a frontier nation. Now we must embrace the next frontier. America's Manifest Destiny in the stars … The American nation was carved out of the vast frontier by the toughest, strongest, fiercest and most determined men and women ever to walk on the face of the Earth … Our ancestors braved the unknown, tamed the wilderness, settled the Wild West … This is our glorious and magnificent inheritance. We are Americans. We are pioneers. We are the pathfinders. We settled the New World. We built the modern world. (Trump, 2020)

And in his 20 January 2025, Inaugural Address to Congress, he again drew on the rhetoric of colonialism, manifest destiny, and frontierism:

> The United States will once again consider itself a growing nation, one that increases our wealth, expands our territory, builds our cities, raises our expectations, and carries our flag into new and beautiful horizons. We will pursue our manifest destiny into the stars, launching American astronauts to plant the stars and stripes on the planet Mars.

Likewise, in September 2025, acting NASA Administrator Sean Duffy declared that the United States has a "manifest destiny to the stars" (Cotterell & Grant, 2025). He continued: "We're going back to the Moon and then to Mars! We hope that you will join us for this exciting journey as America leads in the final frontier!" (Duffy, 2025). While we have provided just a few examples of many, it is important to note that the language of colonialism is readily utilized in a manner intended to inspire and justify power. Explicit parallels are made with the United States' colonial legacy (framed positively without consideration for the large-scale historical harms, as reflected in our opening quote from the novel *Nemesis Games*). It reveals an ideology of human expansionism, the belief that the United States has the right to "expand its boundaries, colonize other lands and exploit their resources" (Scientific America, 2015). The Moon, Mars and asteroids are seen "as resources to be conquered by first arrivals" (Cotterell & Grant, 2025), just as colonialists' territorial expansionist projects claimed new lands and territories.

While it is important to note that frontierism is a United States concept that was strongly utilized during the Cold War period, where the space race became inextricably linked to the battle for geopolitical and nuclear dominance, it does not resonate in the same way beyond its borders. Globally, there is considerable scepticism as to the use of colonial language as it relates to space expansionism, specifically the application of the term "colonialism." For example, when space enthusiasts such as Gerard O'Neill (1976), Stewart Brand (1977) and T. A. Heppenheimer (1977), published works using the colonial language, the term was critiqued as representing exploitation. This is especially true of states such as India, Bangladesh, and Pakistan, as well as African states where, during the Cold War space race, colonial regimes had only just ended (Day, 2015).

The importance of the historical utilization of colonial rhetoric in public and political discourse is that it lays the foundation for the explicit focus of modern space expansionists for 'neo-colonial' endeavours. This is especially true considering that "judgments on matters of public policy take their cues from rhetoric, and so an understanding of any society's rhetoric will tell us a lot about its ideas, beliefs, laws, customs and assumptions -especially how and why such social features came into being" (Lessl, quoted in Billings, 2006). It is therefore unsurprising that current space expansionists such as Elon Musk, Jeff Bezos and Richard Branson are doggedly focused on colonizing outer space, calling for self-sustaining habitats (Bezos in Hartmans, 2021), stressing the need to "go to space to save Earth" (Bezos in Grush, 2016) and for humans to become a "multi-planet species" (Musk in Vanham, 2023), arguing that, "It's important to get a self-sustaining base on Mars because it's far enough away from Earth that [in the event of a war] it's more likely to survive than a moon base" (Eck, 2018). Yet, like historical colonial language, modern discourse discards the disastrous erasure of people, land rights, the violence and harms of resource extraction, space tourism, and mining, as well as the environmental harms the space industry causes to Earth and its inhabitants (see Rothe & Collins, 2025b for a more in-depth analysis).

Furthermore, today's era of space expansionism not only adopts the historical language of colonialism but also reinforces post-colonial power hierarchies that further embed the interests and power of a few select countries and their privatized industries, dominated by Western power elites (Aganaba et al., 2025; Cotterell & Grant, 2025; Traphagan, 2019). Power, in the case of space expansionism, is increasingly about territorial politics, of which knowledge is central (Foucault, 1980). Laying the

foundation are the United States *Artemis* missions as they strive to be "the first human settlements beyond Earth and pave the way for extraplanetary colonization" (Guenot, 2023). Additionally, the Artemis Accords (2020) acknowledge/enable signatories (Australia, Canada, Italy, Japan, Luxembourg, the United Arab Emirates, the United Kingdom and the United States), as well as a few private companies, to establish exclusive regions for building colonies, mining, tourism on the Moon, comets, asteroids and Mars (Rothe & Collins, 2025b). More simply, this territorial expansion is exercised not only by states and their space agencies, but by select private interests – both individuals and corporations – in an ongoing power grab for off-planet resources, control and the appropriation of Earth-based resources necessary for off-planet expansion. As argued by Limerick (1994) using this language:

> space advocates have built their plans for the future on the foundation of a deeply flawed understanding of the past, [and] the blinders worn to screen the past have proven to be just as effective at distorting the view of the future. (p. 13)

Just as past colonialists characterized the progress of their "society by the decline of another or its usurpation as a conquered nation" (Tumlinson, 2024), current countries and their privatized industries, space-related *progress* will result – and indeed is resulting – in the decline of others, at their expense and entailing their exclusion.

From Earth to Orbit: Terrestrial Colonialism[4]

Given the inequalities inherent in the formation of the space industry, it is unsurprising that many of its practices are couched in the same practices and logics of terrestrial colonialism. Like colonialism of old, where the:

> settler goal of seizing and establishing property rights over land and resources required the removal of indigenes … to control space, resources, and people not only by occupying land but also by establishing an exclusionary private property regime … and build infrastructure. (Glenn, 2015, p. 52)

So to it is with the logics of space expansionism. As we (Rothe & Collins, 2025b) and others have argued (Aganaba et al., 2025; Fraser, 2023), the primary benefits of space exploration are for those global power countries that are already wealthy. Indigenous communities are not among the beneficiaries (Cotterell & Grant, 2025; Dunn, 2025). As Fraser (2023) argues:

> the legacies of colonialism feed inequalities in the modern world that mean that those who suffered from colonialism suffer likewise from space exploration today, because of how they, their relationships to the world, and their land, are dismissed, ignored, and devalued by Western powers.

Additionally, space expansionism is dependent on the utilization of labour, raw materials, capital, intellectual property, scientific expertise, and Earth territories (Durrani, 2019), where prioritization of techno-scientific advancement is placed ahead of the rights and wishes of Indigenous peoples. This includes political social exclusion, where groups are denied access to processes that impact their society and everyday lives (Lake, 2018). Marginalized populations are exploited by the space industry to set up sites for satellite launches (polar orbiting and geostationary), GPS monitoring systems, rocket launch sites and spaceports, and other space-related infrastructure (Durrani, 2019). These space-related sites often appear in places "with existing histories of extraction and exploitation, underscoring a colonial pattern of dispossession and environmental harm" (Pejstrup & Klinke, 2025).

Consider that over 10,000 protestors shut down half of the world's space launches by occupying the Guiana Space Center in Koura, French Guiana in April 2017. As one of the few lingering European territories in the Americas, the French have exercised control over the island since 1964. Originally a penal colony called Devil's Island, France has exploited its occupation of the territory to run the European Space Center, which is the second busiest spaceport in the world. The geographical location of the island, 500 kilometers north of the equator, provides optimum launching capabilities because of the "'slingshot effect' from the speed of Earth's rotation" (European Space Agency, 2025). It is home to 42 companies that employ 1,700 people, and rockets from the European Space Agency, Ariane, Soyuz and Vega series have all been launched from the site (European Space Agency, 2025).

During 2017, protests were organized to draw attention to France's role in a wide variety of issues, including decaying infrastructure, growing unemployment, poverty, and high homicide rates, as well as limited access to medical services, schools and safe drinking water (Durrani, 2019; France 24, 2017). This is despite the large amount of space technology and resultant capital on the island. Consider, for example, Arianespace, a private corporation owned by Europe's state space industry, which has launched 11 different orbital launches since 2016 from the Space Center, earning US$1.4 billion dollars in revenue in one year alone (D'Auria & Fernholtz, 2017). The busy nature of the space port provided a prime location for labour unions and

other protestors to emphasize the disparity between the French and European prioritization of space expansionism over the needs of the Indigenous population. As argued by a protestor, "Its' a number one global industry, and just next to it, in Grand-Santi, in Sinnamary [nearby towns], there's no potable water, there's no electricity" (quoted in D'Auria & Fernholtz, 2017). Another protestor noted, "There are rails to transport satellites onto a rocket, and there's no train, no metro, no night bus" (quoted in D'Auria & Fernholtz, 2017). In speaking to the symbolism of protesting outside the Ariane launch 5 base, Davy Rimane, a general secretary for the French Guiana Electricians' Union, argued that the French government "only has eyes for the space center" (quoted in Clark, 2017).

During his first presidential term, Donald Trump's administration signed an agreement with Brazil's then-president Jair Bolsonaro to allow the United States' space industry to use Brazil's Alcântara Launch Center. This 2019 agreement resurfaced land rights concerns from Brazil's quilombola, Indigenous Black and poor communities that were rooted in the construction of the launch facility (Durrani, 2019; Mitchell, 2018). Recall that in the 1980s, during the building of the Launch Center, more than 1500 Afro-Brazilians were forcibly displaced from their coastal communities by the Brazilian state (see Mitchell, 2018 for a comprehensive examination). This led to considerable conflict over the decades, including the continued breakage of state promises for economic development in the region. It is an especially contentious issue, considering the port did not have its first successful launch until 23 October 2004. This followed a failed launch in 2003 that resulted in some of the installation being destroyed and the deaths of 21 people (Melo, 2020).

Other examples include the 2019 protests surrounding proposals to install an additional telescope facility on Mauna Kea, a mountain considered sacred by Indigenous populations on Hawaii's Big Island. Concern revolved around the Thirty Meter Telescope (TMT), a US$1.4 billion dollar project, causing significant cultural and environmental damage. Regardless of these cultural and environmental harms to the Indigenous population, the project's construction permit was approved by the States' Board of Land and Natural Resources in 2017 (Wall, 2017), and by the State Supreme Court in July 2019. In this case, space expansionism was, and is, dependent on the prioritization of imperial claims over Indigenous voices, particularly claims over land and resources where technological and scientific progress bolsters justifications for the exploitation of local communities, resources and land. As argued by Kuwada (2015):

> any time Hawaiians – or any other native people, for that matter – come out in force to push for more respect for our culture and language or to protect our places from this kind of destruction, we are dismissed as relics of the past, unable to hack it in the modern world with our antiquated traditions and practices.

Other sites include Lockhead Martin, who in cooperation with the United States Air Force commissioned a US$914 million dollar contract for a Global Positioning System (GPS) for monitoring space junk. The S-band phased-array radar, called Space Fence, was built on Kwajalein Atoll in the Republic of the Marshall Islands, a United States territory (Blanton, 2020; Ferster, 2015). The radar broadcasts bands of energy along a distance of 1900 miles, 24 hours a day, seven days a week (Banton, 2020). The Marshall Islands have long been subject to the United States Empire for strategic military positioning (US Department of State, 2024).

Durrani (2019) reminds us that the longstanding Mojave Desert space operations in the United States, despite providing employment to the mostly Black and Latino residents, have not improved the economic conditions for the community. He relates this to the colonial legacy of capitalist-colonial violence in the region, whereby Mojave was a vital site for mining and manufacturing for the Southern Pacific Railroad. Or consider Sweden's Esrange Space Center above the Arctic Circle for orbital rocket launching capabilities, which was built outside of Kiruna, a mining town. The Swedish Space Corporation (2025) claims "it has access to a vast, unpopulated impact and recovery area as well as facilities for satellite launches and rocket engine testing." However, activities at the Space Center, including launches, "threaten the ability of the Indigenous Sámi to engage in reindeer herding – a practice that is central to their way of life and ecologically beneficial for the native flora" (Aganabi et al., 2025). Indigenous herders argue that the agency's activities at the launch site "disturb the reindeer and show insufficient regard for the herders' legally recognized rights to the land" (Ojani, 2024).

Beyond facilities, the grab for resources needed for the current race to space also reinforces colonial logics. This includes claims on natural resources for the acquisition of rare minerals through the mining of Mars, the Moon, and asteroids (Rothe & Collins, 2025b), but also to provide the materials for the construction and building of space vessels. For example, consider that the space industry is largely dependent on Earth's finite resources for the supply chain process. Rockets, probes, satellites, and space stations are reliant on a large number of supplies and minerals. Rocket structures alone are dependent on an array of precious minerals such as aluminum (bauxite), titanium, magnesium, carbon composites and silica fibers, stainless steel, nickel, chromium, silicon, and niobium for the rocket structure (Wani et al., 2025; Headed for Space, n.d.; Rothe& Collins, 2023). This does not account for the vast number of other parts, components, and equipment utilized in data chips, processors,

semiconductors, wires, connectors, engines, guidance and air systems, thrusters, propulsion systems, and rocket fuels. Significant amounts of energy and resources are expended, including non-renewable resources, in the extraction, processing, and operations of space assets production, leading to environmental devastation and the loss of ecological diversity, particularly where this involves mining (Agrawal, 2024). Consider aluminum mining, an industry that has a long history of exploitation with some destructive impacts on human life. For example, in the United States and Canada from the 1920s until the 1940s, large dams needed for aluminum factories had disastrous environmental impacts and resulted in many Indigenous people being forcibly displaced (Padel & Das, 2006). The factory emissions also caused considerable pollution of the surrounding communities.

Just as then, we continue to see environmental harms and destructive impacts on local communities related to aluminum. For example, the Nalco bauxite mine, situated along the summit of Panchpatmali hills in Odisha, India, has polluted the tribal surrounding lands, making them no longer fertile for crops. It is projected that the bauxite mining would lead to roughly 2000 villages being severely affected, "resulting in the displacement of them, damaged water supply and degradation of the local forests" (Hazra, 2025). Odisha is the slated site for further mining and refineries under the guise of bringing economic opportunity to one of the country's poorer districts. Large corporations like Utkal Alumina, Hindalco and Sterlite/Vedanta, are pursuing projects in the region, and while there might be economic benefits, they will not be for the local population, who in some cases have been offered resettlement packages, poorly compensated employment and a false narrative claiming a boost to their local economy. As argued by Padel and Das (2006):

> The history of how other countries were induced to make the aluminium industry central to their economies shows a highly contrasting pattern: after an initial investment phase, of fine promises and intensive construction, the industry promotes external control and economic dependence, which ends up stifling a region's prosperity altogether. (p. 62)

While we have offered the example of aluminum mining due to the overwhelming use of aluminum bauxite in rocket structures, the history and current practice of mining in less industrialized countries result in a power struggle between foreign states and corporate interests, with little regard for the Indigenous communities who are often told they will prosper from the "development." The reality, however, is that they are often forcibly displaced, subjected to lower standards of living and suffer an erosion of their societal values, lands, and cultures, as noted above (Leyton-Flor & Sangha, 2024; Mongabay, 2024; O'Faircheallaigh, 2023).

In addition to the colonial capitalist violence related to space asset construction, there are also environmental harms that result from space flight launches. As argued by Ryan et al. (2022), rockets "are unique among anthropogenic sources, due to direct injection of pollutants to all atmospheric layers" (p. 2). The number of space launches and objects has increased exponentially over the last several years – in 2023 2,664 objects were launched into space (United Nations Office for Outer Space Affairs, 2025); in 2024, there were 2,849 space objects; and in 2025 there were 341 rocket launches, of which 329 were successful (Rocket Launch, 2025; United Nations Office for Outer Space Affairs, 2025).

Emissions from rocket launches, fuel consumption, polluting toxins and carbon dioxide all impact Earth's environment (Maloney et al., 2022). In the name of progress, rocket launches release emissions from several types of rocket fuel: hypergolic fuels, kerosene, liquid hydrogen (cryogenic) and solid fuels (Ryan et al. 2022). Emissions from combustion common across all propellants include nitrogen oxides and water vapour, but carbon-based, kerosene and hypergolic fuels produce black carbon (Dallas et al., 2020). Consider the use of Rocket Propellant-1 (RP-1), which is preferred because it is cheap, stable at room temperature, and a powerful combustant. It has been found that each rocket launch using RP-1 emits around 1000 metric tons of black carbon into the stratosphere. This would increase the stratospheric temperature by as much as 1.5 degrees Celsius, as well as further thinning of the ozone layer (Piesing, 2022). With the rising number of launches, the environmental impact will worsen and further contribute to the climate crisis. The Global South bears the burden of pursuits of the Global North, thus culminating in a reassertion of global hierarchical power relations due to the uneven distribution of harm. As Pejstrup and Klinke (2025) rightly note:

> Rocket launches not only release pollutants into the local environment but also exacerbate global warming, thus disproportionately impacting populations in the Global South. For societies that have begun to interrogate their settler colonial origins, a recognition of this symbolic violence seems pertinent.

Furthermore, considerable ecological damage is caused at launch sites and in the surrounding areas. Wildlife habitats and ecological systems are not only impacted by the rocket propellant emissions, but by trash, fires and debris from failed and successful rocket launches and Earth-orbit re-entries, and space debris that is both abandoned in space and crashes back to Earth. Simply, Earth, especially geographic areas and their inhabitants most vulnerable to climate disaster, become subject to

the colonial imaginaries, where launch sites, as well as surrounding ecological systems, become blank slates or laboratories for scientific pursuit of advancement (Greenhough, 2006). Through the lens of colonialism, they become conceptualized as "distant, isolated, uninhabited, and abstract spaces" (Matsuda, 2007, p. 230).

While there has been increasing concern about the environmental impact surrounding launch sites, there has been less attention on the disproportionate impact they have on already marginalized communities. For example, after the November 2024 Starship launch on Boca Chic Beach, Texas, the location of SpaceX's launching pad, residents complained about the plume of fire and smoke's impact on sacred lands of the Carrizo/Comecrudo Tribe of Texas (Hinojosa, 2024; Paulsen, 2024), yet when Starbase "citizens" – mainly SpaceX employees – voted to become a city, there was little to no discussion, consent or consideration of the Indigenous people whose ancestral lands SpaceX encroached on and is polluting (Aganaba, 2025; Hinojosa, 2024).

While environmental harm has devastating impacts for *all* people on Earth, as noted previously, there is a differential impact on Global South countries and previous colonial territories. Climate change exacerbates existing disparities for poor and vulnerable communities, such as worsening poverty, widening economic disparities, foiling development efforts and violating their inalienable rights (Agrawal, 2024). According to the Global Climate Risk Index, the poorest states in the world have the lowest industrial pollution levels, yet they are most susceptible to the harms caused by climate change (Eckstein et al., 2021). Consider that the 10 countries most vulnerable to climate change and adaptation solutions include Chad, the Central African Republic, Eritrea, the Democratic Republic of Congo, Sudan, Guinea Bissau, Afghanistan, Mali, Sierra Leone, and Madagascar (Oxfam, 2025). Furthermore, the effects of climate change felt within countries make inequalities more acute. This impacts poor, Black and Indigenous people, and communities of colour, the hardest (Generate Climate Europe, 2022). As noted by the World Bank, it is estimated that by 2030, some 135 million people will be driven into poverty as a direct result of the current ecological crisis (Jafino et al., 2020).

From Orbit to Earth

> *Holden:* That seemed to be the human pattern – reach out to the unknown and then make it into the sort of thing you left in the first place. (Corey, 2017, p. 48)

As noted above, and as reflected in the opening epigraph, settler colonialism results in colonists shaping the "environment into something familiar" (Fraser, 2023). It is also worth noting that the geopolitical landscape surrounding the space industry is "inextricably linked by the spatial power of privilege and sacrifice" (Klinger, 2021, p. 667). This is not surprising given that the expansionist agenda and colonial practices have long relied on the politics of exclusion (Cooper & Stoler, 1997; Rodriguez & Huizer, 2019; Stoler, 1992). Beyond political or social exclusion, processes of exclusion (and inclusion) of hierarchies are related to what has been referred to as social ontology (Pocock, 1957). Sibley (1995) suggests that this includes geographies of exclusion that he describes as a landscape of exclusion: "social and philosophical geography that melds ideology with place in an exercise of social, economic, and political power" (Allman, 2013).

After all, access to space technology is dominated by a handful of powerful countries, such as Russia, China and the United States, followed by India and the European Union, which exacerbates global stratification and inequalities by providing differential access to space technologies and the primacy of Western technologies and knowledge. Take, for example, global positioning systems and access to satellites that allow powerful countries to surveil, spy, utilize drones, and advance military technologies, very often to be deployed against less powerful states, territories and marginalized populations. As an example, consider how space-based military surveillance, such as the United States NROL-44 in geosynchronous orbit (Abbany, 2020) and China's Yaogan satellites (Jones, 2023), serves as a military resource, yet they have a Foucauldian notion of panopticism where persistent surveillance provides permanent visibility of marginalized groups, territories, and other countries. As examples, consider the Yaogan-41 satellite that allows China to continuously surveil Taiwan and the entirety of the Indo-Pacific region (Swope, 2024) and systems such as the aforementioned Space Fence, whose:

> mission is space domain awareness. Space Fence provides the Space Surveillance network with enhanced SDA in all orbital altitudes, a better revisit rate of objects in low-Earth orbit, and an increased capability to create initial orbit determination on new objects. We're expected to field this capability to achieve actionable space domain characterization. (Major Bryan Sanchez, quoted in Blanton, 2020)

The radar's mission extends beyond merely tracking space objects as it monitors their movement and spacing in both low-Earth (altitude of 400–1200 miles above Earth) orbit to geosynchronous orbit (altitude of 22,236 miles to allow satellites to match Earth's orbit), intending to gather data "to identify, characterize and understand factors that can impact space operations [that] makes our nation [the United States] and its allies better prepared to act against potential threats" (Blanton, 2020). This provides

a "strategic military position from which to continue postcolonial violence on Earth" (Durrani, 2019). Here, capital and global power are central to claims over territory and geography, not only vertically but also Earth-based resources and virtual spaces. To digress, let us return for a moment to recall that past colonial endeavours, dating back to the fifteenth century, involved wars and conflicts over territories vying for dominance and control. For example, recall the European colonialization of the Americas and Africa from the mid-1400s to the late 1900s (Bitterli & Robertson, 1986; Parker & Rathborne, 2007), the United States and Mexico dating back to 1846 (Marquez, 1997) and the French–Indian conflicts of 1756 (Cave, 2004; Fowler, 2005), to name a few. As it was then, so it remains today. Thus, it is not surprising that, in 2017, the United States officially defined space as a warfighting domain (Rothe & Collins, 2023). The main actors involved in space weaponization are the United States, China and Russia, followed by India and Europe. They also dominate globally when it comes to the size and scope of their militaries and consider space a domain that is necessary for strategic military advantage.

Here again, the colonial concepts of manifest destiny and frontier are drawn on in the race to dominate space. Consider that in 2015 China established its Strategic Support Force responsible for space operations in space, cyber, electronic and psychological warfare capabilities "to protect Chinese interests in the 'strategic frontiers' of space" (Costello & McReynolds, 2018). Also in 2015, Russia officially created its Space Force, despite having a military branch focused on space since 1992 (Nagashima, 2023). In 2019, France established its Space Command, and the United States consolidated its military space efforts into the Space Command and Space Force (Lampakis, 2021). These efforts are rooted in national security and defence, as well as colonial logics and frontierism. As stated by the French Armed Forces Minister Parly, "If space was the 'new frontier' of the 1960s, there is no doubt that today it is a 'new front' on the battlefield" (Parly, 2021). Or, as President Trump stated during his 29 August 2019 announcement of the consolidation and creation of Space Command and Space Force:

> From our nation's first days, America's military blazed the trails and crossed the frontiers that secured our nation's future … Today, we salute the heroic men and women who will serve in SPACECOM and keep America's horizons forever bright and forever free. (Trump, 2019)

Important here is the geopolitical power over rendering what some might view as fantastical ideas (i.e. space wars) concrete by "engaging the tangible processes through which the immensity of the cosmos is made political, differentiated, and contested" (Klinger, 2021, p. 667). This exposes the political and private stakes engaged in the militarization and privatization of outer space. Dominance over the vertical has countries vying for supremacy over space weaponization (Dolman, 2002; Weizman, 2002), where whoever holds power over outer space has supremacy over Earth-based warfare. As Sean Duffy (2025), NASA acting administrator, recently reiterated, "the Chinese want to get back to the moon before us. That's not going to happen. America has led in space in the past, and we are going to continue to lead in space in the future." Here, we argue that gaining dominance and power over space through military dominance relies on colonial logics, where claims of scientific advancement, modernity, futurity and objectivity (Byrd, 2011) replicate European settler ideologies of conquest, pillaging and violence (in this case, control over preemptive violence).

Concluding Thoughts

> Not content with the boundaries imposed by gravity, oceans, or ice, Europeans sought possession of all their eyes could see. (Byrd, 2011, p. 2)

Just as European colonial projects sought to expand their boundaries, to take "possession of all they could see," as reflected in the section's opening epigraph, so it is with today's space expansionist logics. Past colonial ambitions were territorial and resource grabs that resulted in conflicts, wars, displacement, deaths and, in some cases, slavery of Indigenous peoples, which have had long-enduring ramifications. As we have demonstrated here, the logics and rhetoric (and in some cases practices) of past colonialism continue to be drawn on in the race to space. We gave several examples of what we refer to as terrestrial Earth-based settler colonialism in the pursuit of space expansionism from displacement, exclusion of local populations (i.e. the politics of exclusion through geographies of exclusion that limit physical and economic access to specific sites related to space launches) and environmental harms. Consider too the territorial and resource grabs related to the race to mine the Moon, particularly between China and the United States, which is not surprising given that the value estimates of the Moon's resources range up to US$1 quadrillion dollars, including the "Moon's water at more than $200 billion … helium at $1.5 quadrillion … metals at $2.5 trillion" (De Mott, 2023). Or the race to the asteroid dubbed 16 Psyche, believed to be made of pure metal valued at US$10,000 quadrillion dollars to the weaponization of space to further and protect national interests (Rothe & Collins, 2025b). We are reminded of a quote in the novel *Infinity Gate*, by M. R. Carey (2023):

> You didn't need to fight resource wars if you could Step into another world. So what if you poisoned your air, your water, your soil? You could just grab some more. And if your population was spiking, you could open a new frontier on another Earth. (p. 37)

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[1] Here it is important to note that "space" refers to specific geographies, both on Earth and beyond. While differentiation between certain bodies and places is possible, we are focused on the symbolic and material creation of space as it is occupied, utilized and exploited for resource extraction for the purposes of state power, private capital accumulation and how they intersect. Therefore, while settler colonialism is focused on the occupation and control of certain land for sustainment, so is space expansionism, as it is conceptualized for the survival of humanity (see Traphagan, 2019 for a more in-depth discussion).

[2] As Klinger (2021) rightly argues, "Emperors and monarchs claimed that 'divine mandates' installed them in their thrones … Religious figures backed these claims to territorial control by anthropomorphizing the evolution of the cosmos to claim privilege vested in them by a "God" or "gods" that "resided" in "the heavens" (p. 668) and aligned themselves with "state or imperial power" thus, positioning themselves as indispensable "in exchange for subordination and material wealth transfers from other people. Powerful actors past and present used claims of exclusive access to the ultimate high ground, even if only imagined, to organize regimes of territorial control" (pp. 668-669). Likewise, manifest destiny refers to a "belief in a preordained right to explore, colonize and exploit a given territory, as white, European settlers did in the 19th century in the USA and the American West." (Bleddyn Bowen, quoted in Jones, 2025).

[3] We agree with a number of scholars who have argued that colonialism and imperialism in the present day are difficult, if not impossible, to distinguish (Kohn, 2012; Kumar, 2021; Pitts, 2010). And while some scholars have argued they should be distinct (Arneil, 2017; Finley 1976; Seeley, 1883), we agree with Said (1993) that colonialism "is almost always a consequence of imperialism" (p. 9). Even if it is argued that colonialism involves "extensive domination" and imperialism is about "substantial settlement, the "official, popular, and even scholarly usage is unstable, and thus, the terms 'colonies' and 'postcolonial' are applied equally to spaces of significant settlement and to those without" (Pitts, 2010, pp. 213–214). We agree with Kumar (2021) that colonies "are part of empire [and] only have existence as manifestations of imperial drive" (p. 304).

[4] Note that the verticality from Earth to orbit in relation to space and resource extraction that are part and parcel of space expansionism refers to the seizure of land and control of territories (e.g. launch sites), labour, resource extractions (e.g. minerals and raw materials required in manufacturing rockets, launch vehicles, satellites, etc.) that occur here on Earth. After all, space expansion is embedded "in terrestrial geographies and socio-political relations" (Ojani, 2025, p. 606).

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