

Negative Implications of the Production of Aircraft on Society

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

Aviation has become a necessity throughout the world today; it revolutionized the way that the world interacts trans-continently throughout the present day. People, corporations, and governments utilize aircraft to travel, trade, transport victims to hospitals, and provide relief efforts for areas impacted by natural disasters. More relevant to this paper, devastating wildfires. The advancement of aviation has led to countless benefits, but it also damages the environment, supports economic exploitation, and foments geopolitical strife. Aircraft are fueled by oil and gasoline, releasing carbon dioxide, and contributing to global climate change. This very resource has been the cause of multiple wars to gain control of it. The metals used to engineer aircraft have also been obtained due to the exploitation of international economies. To analyze these cons, questions need to be asked: what resources are used to build and fuel aircraft? Where are these resources extracted from? How are these resources extracted? The full story of the aviation industry and its full impact on society must come to light as the answers to these questions continue to rise.

Problem

Wildfires are devastating natural disasters that have gradually worsened with climate change over time. From January to October 2020, there were 45,635 wildfires in the United States. The number rose to 47,057 during 2021. On July 13, the Dixie fire broke out in California, burning through 9,632,309 acres of land. It became 94% contained on October 12 (Insurance Information Institute, 2021). The intensity of these fires has become too strong to contain on foot, resulting in the need for aerial firefighting aircraft. These aircraft range between small military aircraft, such as the P3-Orion, to large passenger aircraft, such as the DC-10.

Aviation has provided relief in this sector, especially as fire management has become a harder task to tackle. The demand for firefighting aircraft has increased, not only due to the increased strength of the fires, but also the increased quantity of fires occurring on Earth.

Engineering the aircraft used in these wildfires and getting them in the air is not without faults. The initial step to is obtaining the resources required for these projects; many of the metals used in aircraft are sourced from countries that have been devastated by colonialism. These are known as conflict minerals, “[Conflict minerals] is a term used to describe certain minerals such as gold, wolframite, cassiterite, columbite-tantalite, and their derivative metals.... That are sourced from mines under the control of violent forces in the Democratic Republic of Congo (DRC) or the surrounding countries,” (Aerospace Industries Association, 2013). The resources used to fuel the aircraft also stem from questionable politics. The majority of the aviation industry utilizes kerosene, otherwise known as Jet A-1. Kerosene is used in jet planes, large aircraft, and helicopters; this substance is derived from oil and gasoline (Peterson, 2021). The Middle East produces over 30% of the world’s crude oil and holds 40% of the world’s conventional gas reserves as well (Rasoul et al, 2015). Due to the abundance of oil in this region and the increasing reliance on these resources, the Middle East has been a breeding ground for conflicts for decades for imperialistic powers. Oil, in particular, has been a leading reason for war. Wars over oil make up one-quarter and one-half of interstate wars since 1973; Iraq, Iran, Kuwait, and Yemen are just a few countries that have been impacted by these aggressions (Colgan, 2013).

Countless civilians have been put at risk and harmed due to these conflicts. The numbers of people, homes, societies, and generations that have been affected by these actions are countless. The purpose of engineering is not only to build, but to acknowledge how technologies

impact populations around the world, which has seemed to slip under the radar in this scenario. The end does not justify the means. Ignoring the bad politics of a technology does not make them nonexistent. In order for this situation to change, society must acknowledge that harm is taking place and ask itself an important question: how can the current corrupt practices associated with resource extraction be put to an end while the aviation industry continues to safely, and efficiently, operate to fulfill the world's needs?

Technical Project

For my technical project, I have been tasked with designing an aerial firefighting aircraft with an assigned team. Due to the intensity of wildfires, aerial firefighting aircraft have been a necessity due to the relief they provide on-ground firefighters, but there is a need for improvement. The existing aircraft used are older, are cost inefficient, and are not well maintained. This results in major issues as the wildfires will continue to devastate land while extra, and avoidable efforts, are required to put out the fires. This occurred in Lebanon in the fall of 2019. 103 fires had broken out, and the country's firefighting aircraft was not able to provide relief as the helicopters had been out of commission and improperly maintained (Ahmed, 2019). The market needs a new design that would be easy and cheap to maintain while also being efficient enough to fight raging wildfires.

The aircraft that we are designing must fit the given requirements of payload capacity, speed, and flight requirements. At the same time, we are required to make it cost efficient and low maintenance. Another key design feature that needs to be considered is making the aircraft sustainable. That means that it must emit as little pollution as possible, be fuel efficient, and be composed of sustainable materials. The goal of this aircraft is to be sustainable while still

efficiently fighting fires. The airplane should not be contributing to the already worsening global climate change. Our final design, Material Girl, is a large-winged aircraft that fits the given requirements while functioning sustainably.

Research/Analysis

The Democratic Republic of Congo

Building aircraft requires many resources. Some of which are extracted in unethical ways. The Democratic Republic of Congo (DRC) is a major hub for imperialist practice over its abundant mineral resources. King Leopold of Belgium commanded these practices and committed atrocities during his leadership. Multiple stories were accounted for in George Washington Williams' Open Letter, addressed to King Leopold, described how Leopold seized conflict minerals through force and oppression and used racialized and gendered violence to enforce these practices (Williams, 2019).

Throughout the occupation, the Belgians enforced a clear intent of racial supremacy. The Belgians invaded a land that was not theirs, occupied it, treated the natives as less ("the African soldiers and labourers of your Majesty's Government fare worse than the whites..." (Williams, 2019)), and succeeded in acquiring the resources that they desired, all through tyranny. Gender was also a major factor in this "game" that King Leopold ran in the DRC. The Belgians used women as objects in order to hold this extra power over the men that they forced into slavery. According to one source, "women are imported into your Majesty's Government for immoral purposes... black men are dispatched to the Portuguese coast where they engage these women as mistresses of white men," (Williams, 2019). This demonstrates how Belgians utilized both race and gender simultaneously as weapons to enforce power over the DRC. This tactic allowed for

not only physical oppression, but also mental oppression, by minimizing the Congolese's self-worth and value. This suppression gained a stronghold on the native population, and the damage was irreparable. It became part of the culture and was passed down through generations due to the immense mental effects on the people. Nkrumah stated, "[imperialists] use the old colonialist methods of religious, educational and cultural infiltration. For example, in the Independent States, many expatriate teachers and 'cultural ambassadors' influence the minds of the young against their own country and people," (Nkrumah, 35, 1965). The weaponization of race and gender imprinted onto the country and stemmed into different aspects of society as well. This led to a hate towards one own nationality, and the idea that imperialist countries were supreme. These ideas are not easy to take away once instilled in people's mind, especially after they are continuously taught and passed down generationally.

The Belgian occupation of the DRC occurred in the 19th century, but the DRC's resources are still sought after to this day. Even though the physical occupation has long since ended, imperialistic forces still pressure the country to fulfill their needs. This form of imperialism is known as neo-colonialism. Nkrumah argues that "the essence of neo-colonialism is that the State which is subject to it is, in theory, independent and has all the outward trappings of international sovereignty," (Nkrumah, ix, 1965). This form of colonialism "represents imperialism in its final and perhaps most dangerous stage," (Nkrumah, ix, 1965). This is because while countries may have physical sovereignty, they still do not have complete control over their economies; what goods are being produced and exported are determined by international forces to help advance their interests. Nkrumah highlights this through his example on agriculture and nutrition, "there are, however, imperialist specialists and apologists who urge the less developed countries to concentrate on agriculture and leave industrialisation for some later time when their populations

shall be well fed,” (Nkrumah, 7, 1965). This push towards agriculture left underdeveloped nations in a stalemate, making it harder for them to advance forward due to their populations remaining malnourished, even though agriculture increased, “the world’s economic development, however, sows that it is only with advanced industrialisation that it has been possible to raise the nutritional level of the people by raising their levels of income,” (Nkrumah, 7, 1965). The DRC is one of many countries that has likely seen this example of neo-colonialism. By remaining in a non-self-sustaining environment, the DRC would have no choice but to continue to rely on foreign powers.

Many countries had a role in the events that lead to the DRC becoming its own sovereign state, in order to advance their own self interests. The DRC ended up both physically and economically destroyed by colonial forces at play, even after they gained independence. Neo-colonialism in the DRC immediately followed occupation, giving it no room to recover from their own colonization. The aviation industry heavily relies on resources from the DRC and other neo-colonial countries while aircraft produced are beneficial to many societies; the materials used to engineer them are sourced in a way that directly harms the DRC (and other nations) as a sovereign nation, and its people. The DRC may have gained physical freedom but the economic and political state that they were left with was not their choice, and there were still other players determining what would happen with the country. By continuing to utilize resources that have been procured at the expense of others, aircraft are inherently harmful and the good that they may do does not outweigh the harm.

The Middle East

The Middle East tells a similar story when exploring the cross-section of imperialism and resource extraction. Aircraft rely on oil and gasoline that is extracted from this region as the main fuel source. Foreign imperialism in the Middle East has been a force for decades; tactics such as war and environmental degradation have been used in order for imperialists to secure the fuel that they need, at the expense of native populations. For example, “Saudi Arabia’s war in Yemen has been driven by concerns for oil supply and delivery,” (Orkaby, 2019). The Strait of Hormuz, which runs by Yemen, and is a route for 30% of the world’s oil supply, has allowed for a proxy war between Saudi Arabia and Iran, as each country is vying to have control over oil supply and shipments (Orkaby, 2019). These conflicts have produced some of the world’s biggest humanitarian crises – war, famine, lack of access to safe drinking water, poor healthcare infrastructure – all for the very resource that fuels our aircraft.

The U.S. invasion of Iraq was also an example of this kind of neo-colonialism, as “the United States is simply depleting the developing world's natural resources, compelling the rest of the developed world to remain dependent on American management of the global economy,” (Fouskas et. al, 2005). One of the major premises for the war was the need for oil and gasoline. Throughout this war, civilians were forced to leave their homes, natural environments were destroyed, and air quality suffered: “the deprivation of nutrients is for a long time, but it is much, much worse now, since after the U.S. built bases and deregulated the oil industry. There is thick smoke everywhere— they are extracting oil so fast now, there is no rest, and there is no time for the plants to breathe. It is like a vacuum for them, and for us. The plants go to breathe in the air and their pores are stopped up with waste. They shrivel up and become tired,” (Rubaii, n.d.). A cost-benefit analysis is insufficient when one side is reaping all the benefits at the cost of

other's suffering. Imperialist forces entered the country and controlled the region with no acknowledgement of the other actors in the situation; they treated civilians as lesser: "he says he will confiscate her ID card if she does not move on. This quiets the sobbing woman... The men cannot give her their rations in front of the building, but someone gestures her to the back," (Rubaii, n.d.). The soldiers, which were supposed to be administering aid to those in need, were finding any way to dominate the scenario through intuitions of racial and gender-based violence. They would not give an elderly lady in need her rightful rations; instead, other men, who likely needed their own rations, gave up theirs to help her.

The minimalization of the value of Middle Eastern lives and land is not a new imaginary; through the British mandate in the region, the imperialist forces claimed they were saviors who would restore the region, "so that Arabia would once again become the productive cradle of civilization, a resurrected Babylonia," (Satia, 2011). Arabs were purposely painted in a negative light and the arid climate of the region was used as justification for the intolerable actions that were occurring, "deeply ingrained views shaped by environmental determinism, though, led to portrayals of the tribes as though inhabitants of a harsh environment that could tolerate random acts of violence in ways others could not," (Satia, 2011). This allowed colonialist powers to utilize aerospace weaponry towards excessive violence that they claimed was necessary for their mission. This weaponry requires the exact resources that are produced via imperialism. These resources continuously contribute to global climate change which worsen natural disasters, specifically wildfires. As wildfires worsen, extra efforts are needed to fight them, like aerial firefighting aircraft, which are also fueled by gasoline and oil. As aerial technology is used to combat fires and advance war efforts, the world's dependence on gasoline and oil is going to continue. To account for this necessity, more extraction efforts are needed, but are also

contributing to worsening wildfires: “oil and gas extraction and consumption are major contributors to climate change, the underlying factor in the recent frequent and intense wildfires,” (Ferrar, 2021). It is a positive feedback cycle, and until we implement solutions, the cycle will just continue.

Solutions

There is no clear plan on how to navigate these concurrent issues of imperialism and the need for nonrenewable sources, but there are many initiatives that can be taken to make sure that world is one step closer to improvement. One solution includes reparations for those who have suffered at the hands of greed. The most pressing solution is to begin looking for more sustainable ways to build and power aircraft. There are currently companies that have begun to experiment with sustainable and zero-emission aircraft. These aircraft are hydrogen and electric powered. Some of these startups include Heart Aerospace, ZeroAvia, and Vertical Aerospace. Investing in these companies to help advance and progress research would help the world reach a solution at a quicker rate.

Investments could also be made to several material science companies that would do research on replacements for the conflict minerals that are currently used in aircraft. Not only that, but initiatives could be made to recycle these materials from old technologies; this would discourage continued unethical mining and extraction of these resources. These solutions are very complicated, and it would take years, or decades, to see any progress in the field. In the meantime, pressure should be placed on imperialist nations to discourage the continued practice of unethical mining and processing. Nkrumah discusses how colonialism not only ensures minerals, but also finished products, “possession of colonies gives a guarantee to the financial

oligarchy of the owning country of the monopoly of actual and potential sources of raw materials and outlets for manufactured goods,” (Nkrumah, 83, 1965). Therefore, the factories used to manufacture the goods are placed in occupied countries, resulting in more economic control over them and environmental degradation. As Nkrumah discussed in his book, this processing should be moved to the countries that extract and heavily utilize these resources, to alleviate stresses on the DRC. The DRC would gain more economic and physical autonomy. The resulting change would be immense. As this occurs, research should still be encouraged, because aircraft do utilize conflict minerals, which are limited resources and will not be able to be utilized indefinitely.

As research and manufacturing changes are being implemented, the current resources used could be mitigated to ensure to most ethical process for extraction possible. There are current regulations set up by both the Aerospace Industries Association and the US Securities and Exchange Commission that read as follows:

- **Applicability:** Is the company in question a US public company? Are conflict minerals necessary to the functionality or production of product? If either of these are a no then the company cannot move forward to access such minerals.
- **Reasonable country of origin inquiry:** Are the conflict minerals needed only from recycled scrap or originating from outside Covered Countries?

If yes..

- **File SEC form SD:** Describe the measures taken to make that determination. Steps stop here.

If no...

- File SEC form SD with Conflict Minerals Report: Post Conflict Minerals Report on website for one year, use appropriate due diligence such as OECD guidance, 3rd party audit or CM processes, and describe part DRC conflict-free status (next bullet).
 - DRC Conflict Free, Not Confirmed to be DRC Conflict Free, DRC Conflict Undeterminable. Steps stop here (SEC, n.d.).

These regulations are currently set up for conflict minerals, but legislation efforts can be put in to extend them to oil and gasoline as well to ensure their current sources are ethical. Multiple countries, including the U.S, put sanctions on Russia after the invasion of Ukraine; similar efforts should be shown for the wars in Iraq and Yemen, for example, to put a stop to the current proxy wars.

The last, easiest, and cheapest effort that must be taken by all institutions is acknowledgement and education. Imperialism is an inherently bad practice, whose ill-gotten products flow into the aviation industry, resulting in harmful technology. This practice is not discussed within schools, and governments do not acknowledge past mistakes, either. The subjects are taught without depth, but it is important to include that analysis. By changing the way that society thinks, practices will naturally begin to shift as well. Imperialist countries have, and still, oppress and exploit native populations around the world. Change will not be seen until citizens grapple with the damage their own countries and corporations have caused. Once this wave of awareness comes, changes will be seen and new, ethical practices will be implemented at the institutional level, counteracting the current.

Conclusion

There is still much research that needs to be done to deliver a full analysis about the overall impacts of imperialism and how it intersects with resource extraction. Societies have been destroyed and native populations have suffered, all so that imperialist forces can take control of resources that they need for many applications, but specifically the aviation industry. Firefighting aircraft, for example, have good politics because their purpose is to fight fires, they also have bad politics when looking at how they were manufactured and how they are being fueled. These types of discussions need to happen with all technologies.

The information presented in this paper only scratches the surface of the deep research and discussions that need to occur. The solutions proposed above are a good beginning, but there are future studies that need to be conducted. The biggest one at hand currently is: what are the economic implications of the solutions? The research needed to produce sustainable fuel and material sources and to recycle metals is not going to come cheap. The reason why these options are not readily available is because they cost a lot up-front, which can be seen as an issue.

The purpose of engineering is to benefit our society, and when the opposite is occurring, the contradiction should be highlighted. By acknowledging the bad politics associated with aircraft and educating others, the issues will be widely accepted and that is when legitimate steps can be taken to help better our world and give back to those that have suffered under the hands of imperialism while making the aviation industry more sustainable and viable.

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