The Future of Flight

Jossue Sarango

Are Electric Planes the Future?

In a revolutionary world that discovers, evolves, and changes day by day, people often learn that their favorite activities might not be so great after all. A study discovered that in 2023 alone, approximately 4.4 billion passengers traveled via airlines worldwide, an estimated 1.8 billion were international travelers, and 2.6 billion were domestic (Hyde 2024). Only a small fraction of that amount understood just how carbon-intensive flights truly are. To put that into perspective, researchers calculated planet Earth inhabits roughly 8.2 billion people, of which 33.2% are not even of legal age to fly alone (Ang 2021). Aircraft, either for leisure or for business, shape the world as we know it. Your Amazon package, your mail, and your medications are all forms of air cargo that rely on domestic air travel to get from one destination to another. Airplanes act as a portal to connect countries worldwide and allow families to connect without boundaries. Famous airlines such as United, American Airlines, and Delta fly in and out of the 20,000 airports inside the US. These multi-million corporations have demonstrated resilience against global pandemics and continue to profit from a growing consumer audience that enjoys traveling the world. At a glance, airplanes are a revolutionary invention that are perfect for connecting lands and transporting goods. The truth is, with every plane that goes into the sky, toxic fumes and gases are let into the Earth's atmosphere.

Global Warming

A recent study discovered that the United States alone accounts for 200 million tons of the global CO2 total, approximately 23%. That same study estimated aviation's contribution at 2.5% of global CO2 emissions, a number that might seem like a small fraction, but its impact is disproportionately large and growing rapidly (Overton 2022). While the common misconception that planes dump toilet waste during flights is undoubtedly false, planes do indeed produce a

different kind of waste: carbon waste. This waste is not only harmful due to the sheer volume of emissions, but also specifically where they are released. Aircraft, relative to other forms of travel, fly high in the Earth's atmosphere, effectively capturing heat and trapping exhaust fumes that are constantly released during flight. Through global warming, the impact of CO2 emissions is already being felt throughout the globe. The USEPA found, "scientific studies indicate that extreme weather events such as heat waves and large storms are likely to become more frequent or more intense with human-induced climate change" (USEPA 2025). The stability of our societies and economies is nevertheless threatened by these gases, driving moral character to question what can be done?

Despite commercial airlines being driven by profit and finding areas to cut corners with the goal of increasing revenue, growing awareness has driven airlines to cut back on their minimalist spending habits to identify solutions to existing emissions. A solution identified by researchers and made popular by media outlets is hybrid technology.

How does Hybrid-Technology Work?

Hybrid-electric aircraft work differently from traditional aircraft. Rather than relying solely on combustion engines, which burn fuels and release toxic fumes as a by-product, hybrid technology incorporates electric motors to reduce the reliance on traditional engines. In essence, aircraft will stop depending solely on combustion engines and rely on electricity to power all non-essential systems and produce thrust. Some popular electric commodities popular to consumers are Wi-Fi, reading lights, and movies on infotainment screens. From an operational standpoint, electrifying systems means relying on batteries to power radio communications, power steering, and cruise control. Yet the integration of batteries does not stop there. What truly makes hybrid technology unique is its ability to allow batteries and engines to work seamlessly

together. This synergistic interaction encompasses electric motors operating in parallel to internal combustion engines within an aircraft to produce augmented power that is both effective and reliable.

To the ordinary traveler, this translates to a quieter cabin experience throughout the entire flight, faster connection speeds, and a better self-appreciation for flying green. Research already suggests that engaging in environmentally friendly practices directly impacts one's happiness (Amori 2025).

Will Airlines Adopt This Technology?

For decades, the aviation industry has steered away from the idea of introducing cleaner energy practices, labeling them as costly, complex, and frankly unnecessary. Despite this, public demand, fueled by increasing awareness, has demanded changes to be made in an industry that directly contributes to greenhouse gases.

In 2022, the electric aircraft market was estimated to be about $8.8 billion, with an estimated reach of roughly $37.2 billion by 2030 (Mehra 2022). Scientists have raised their voices to promote a safer alternative that still allows airlines to maintain profit margins and reduce their carbon footprint. Driven by aircraft manufacturers, an analysis on the correlation between hybrid-electric aircraft and aircraft pollution discovered that the adaptation would allow the United States to reduce greenhouse gases and petroleum consumption by 80% by the year 2050 (Zhang 2024).

The aviation industry can no longer afford to ignore its contribution to the existing global warming problem. European countries like Austria, Belgium, and the Netherlands have already been victims of airline regulations to reduce toxic fumes released into the atmosphere. France is

another example, where the country's national assembly has made the decision to fully ban short-haul flights that could otherwise be traveled through other methods of transportation. The concept behind this decision is true: regional short-distance flights are both inconvenient and environmentally damaging. A typical road trip from John F. Kennedy Intl.. (JFK) to Atlantic City Intl.. (ACY) is roughly 2 hours and 20 minutes, while a flight traveling those same distances takes 45 minutes. Though flying might seem like the faster and more efficient alternative at first glance, it fails to account for the time required to pass through security, bag check-in, and waiting for other passengers to board the flight. Combined, commuting on an electric land vehicle and traveling on a carbon-intensive aircraft take roughly the same time to reach the destination, while the difference in carbon emissions is exponentially large.

Impact of Hybrid Technology on Communities

The introduction of hybrid-electric allows aircraft to travel more efficiently domestically, introducing it as a new viable method of transportation and directly increasing regional funding. Washington State's Department of Transportation conducted a study that identified hybrid-electric aircraft as an opportunity to repurpose neglected local airports and increase local tourism (WSDOT 2020). Shifting towards cleaner skies successfully promotes the usage of airplanes to travel regionally, a modern form of transportation that is faster and more efficient. For airline companies, this shift expands their reach to an audience they once never factored. An American startup company, Ampaire, has recently made headlines due to its bold claims that its new hybrid-electric propulsion technology successfully lowers fuel consumption by 90%, aircraft maintenance by 50%, and noise pollution by 60% (Ampaire 2025). They highlight the benefits of regenerative braking, a hybrid-technology characteristic that allows batteries to charge as the

aircraft is braking or descending. The convenience of this is that hybrid-electric aircraft can continue to travel distances without taking extensive breaks to charge their systems.

Why is This Important?

The introduction of hybrid-electric aircraft challenges transportation as we know it to change and adapt to the needs of the world. Urban cities will continue to expand as human population numbers reach an all-time high. A study analyzing urban infrastructure identified that current transportation infrastructures are inflexible and stationary, forcing traffic to experience jams and congestion (Beebe 2018). The proposed solution is the introduction of an air taxi system that can shift according to the needs of the city's infrastructure. Nevertheless, hybrid technology opens the possibility for multiple discoveries that are sure to change our concept of transportation.

When Will This Happen?

Despite being a newly introduced technology, many airlines have begun to implement testing prototypes and identify methods of mainstreaming hybrid-electric aircraft. Companies like Heart Aerospace and Pipistrel are already leading the way in developing innovative aircraft like the ES-19 and the Alpha Electro.

Having already received the European Union Aviation Safety Agency certification, the Alpha Electro operates using a 60-kW motor and a 21-kWh battery. Combined, the motor and battery allow the Alpha Electro to travel for nearly 160 kilometers, a flight duration of exactly one hour (Walków 2019). United Airlines has recently publicly announced its shift towards air freight carriers to allow for enhanced mobility in densely populated areas (United 2021).

The shift towards electrified skies is happening sooner than we know it, slowly but surely incorporating into the existing fleet of over 200 thousand aircraft (Schwab 2021). As prototypes

and different designs continue to be crafted and released publicly, it is exciting to view the future happening before our eyes. These new aircraft represent a modern era of air travel, one that is cleaner, quieter, and environmentally conscious.

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