Electric Commuter Aircraft: Project ElectriFly

Group 13

The need for greener aviation is critical. While electric cars and sustainable power grids are now commercially available, the aviation industry still has a long way to meet the 2050 climate neutrality goals. Although aircraft flying on sustainable aviation fuel are in operation, and hybrid/hydrogen aircraft are in development, their overall 'environmental footprint' is still uncertain. Electric propulsion offers a promising future by reducing emissions throughout the production and end-of-life phases.

Mission

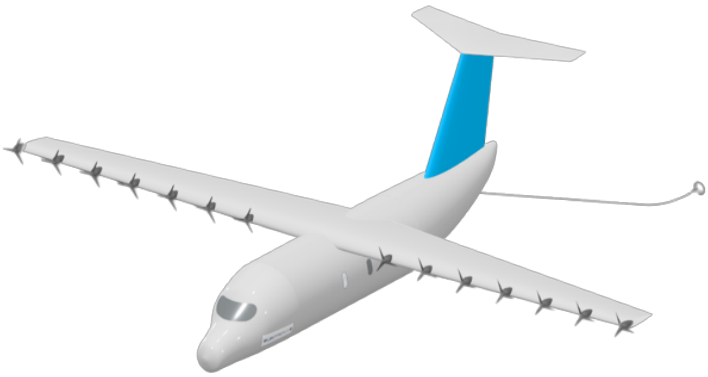
Electric aircraft technology available on the market is greatly limited by its range and scale. To address these challenges, ElectriFly has been designed in close collaboration with the Mid-flight Recharging Drone Team. The technology enables extending the range and reducing turn-around time at airports. Thus, while making short-haul greener, it has the potential to make medium-long haul green with an 80% end-of-life reuse capability.

> *Design an 8-passenger all-electric commuter aircraft having 500 km range with comparable performance characteristics of similar aircraft currently in operation, with the ability to interface with a digital twin and recharge mid-flight.*

By integrating a digital twin interface, ElectriFly can revolutionise predictive maintenance for an entire fleet. Additionally, safety can be improved by monitoring of the aircraft's components' status, while minimising downtime and maximizing the operational life. This reduces fleet-wide groundings by isolating the failure to specific aircraft. Moreover, it enhances the pilot's situational awareness, useful during emergency situations.

ElectriFly's Design

The upcoming solid-state battery technology provides increased safety, restoration opportunities, and improved energy density: with a projected value of 600 Wh/kg, by 2035.



Flying at 15000 ft with a cruising speed of 110 m/s, ElectriFly is designed with a business class layout. The structural, aerodynamics, propulsion and performance are designed in line with concurrent engineering as a continuous iterative process. It features a distributed propulsion system with 14 EMRAX motors to maximise efficiency, with the concept of regenerative propellers to gain energy during the descent phase, while eradicating the need for spoilers. The aircraft structure, integrated with sensors from the manufacturing phase, highlights the use of carbon fibres + PEEK, a thermoplastic with excellent thermal and mechanical properties.

A recharging drone shall recharge the aircraft for a segment of the cruise with renewable energy. The design features a traditional probe-and-drogue system configured to carry electrical cables, integrated with digital twin sensors, this system keeps reliability and efficiency at the forefront. The design is at the final stage of being verified and validated by various external experts. A life-cycle assessment for cost and sustainability shall be performed, along with a comprehensive risk assessment to ensure battery and aircraft safety.

Ready by 2035, ElectriFly is on track to electrify the aviation industry.