#10 - Mid-Flight Aircraft Recharging System

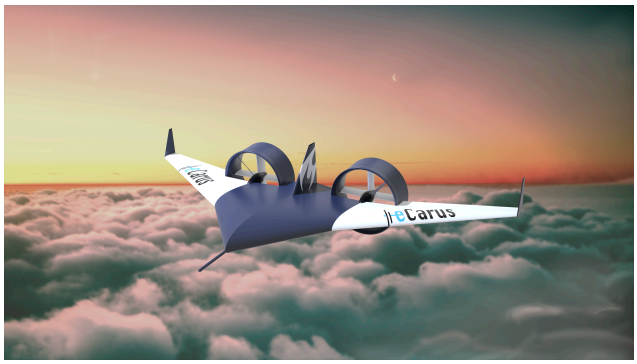
The aviation industry frequently faces criticism and experiences impedance due to its heavy dependence on fossil fuels. One significant challenge that hampers the adoption of renewable-energy-powered air travel is the limited range of such aircraft. In order to address this issue, this project attempts to develop a network of autonomous drones capable of providing renewable energy recharging to aircraft during flight. This system is called eCarus. The key objective is to evaluate whether an optimised design solution is both feasible and realistic as a potential resolution to the problem at hand. For the first time in the DSE, two groups worked together to investigate the feasibility of the system. The eCarus design exhibits adaptability to the aircraft designed by DSE group 13, making this project unique in its approach and collaborative endeavours.

Mission Objective

The eCarus project aims at designing and proposing a plan to create an autonomous system capable of recharging all-electric aircraft mid-flight. The mission need statement is given as "Create an autonomous, in-flight recharging system for carbon-free civil aviation that declutters the airport logistics regarding electrification and hydrogen refuelling, and that can extend the range of all-electric aircraft". The project objective statement is "Design an autonomous drone system comprised of the ground station, drone and on-aircraft dock for in-flight recharging of carbon-free aircraft in 10 weeks by a team comprising of 10 students".

System Design

The design of the project is split between designing the autonomous drone and the system of hubs that supports it. The hubs have been placed at selected regional airports based on how each hub can service most flights while minimising its environmental footprint. An analysis based on the world's busiest flight routes, the costs associated with a hub, and where best to start such an innovative project helped in this decision. The drone's lack of a pressurised cabin allows for an innovative blended wing body design that minimises drag while optimising volume for batteries. The charge is delivered to the receiving aircraft through a custom build probe and drogue design that focuses on safety, efficient energy transfer, and reliability. The drone weighs roughly 6 tons, has a wingspan of 16 meters, and has a range of 665 kilometres. In all, the system will extend the range of electric aircraft on top of being able to reduce their turn around time on the ground by being able to recharge aircraft just before they land.



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[1]Image used: own work (DSE Group 10)