

Group 27 - Ultimate Energy Efficient Aircraft

The aviation industry occupies 2% of global CO₂ emissions and increasing numbers of commercial flights are expected in the close future. With the people of the world having such a strong dependence on quick communication and travel that aviation sustains, the industry must grow, but only in a sustainable way. Thus, if sustainability goals like the IATA 2050 are to be achieved, a change needs to happen.

Mission Objective

Inspired, the mission need statement of this project evolved: "To reduce the environmental impact of aviation by designing a novel aircraft that is capable of transatlantic flights by 2030". Currently, the most efficient aircraft by seat-kilometre is the A321neo, yet it uses Jet A of fossil origin. In order to drive the change and enable net-zero commercial aviation, innovation is necessary. Thus, Group 27 proposes the CH4llenger: the world's first climate neutral transatlantic passenger aircraft completely fuelled by green methane. A proposition of a 'whole-image' concept was formed, looking at sustainability from fuel production to airport operations to take-off all the way to end-of-life; CH4llenger was designed for optimal economic, social and environmental impact.

System Design

With a sustainable market for green methane and a global shift towards energy-efficient aviation, methane is a leading choice and a design comprising of two external underwing fuel tanks was idealised. It is easy to handle compared to the likes of hydrogen and has large flight ranges, unachievable by batteries. In terms of the engine, methane can be substituted in place of kerosene, with few modifications to the efficient LEAP-1A engines to be made, thus increasing the aircraft's adoptability into the market. With removable wing tanks, the safety, maintenance and accessibility of the aircraft are optimised, thus limiting friction to implementation.

Complementing CH4llenger, concepts on how the fuel will be produced, transported and stored at the airport were synthesised. Excitingly, an 'Airport of the Future' concept was idealised by maximising the potential of methane in terms of mobility, but also for the ecosystem surrounding the airport. A new turn-around concept is developed, allowing a transatlantic aircraft to be turned around in under an hour. Furthermore, existing liquid natural gas infrastructure can be used,

thus lowering development costs and increasing methanes introduction to the industry. With a flourishing market, promising competitive landscape and global sustainable shift, the economic prospect for CH4llenger looks bright.

Over the next two weeks, the design will be finalised and visuals for the aircraft created. Future developments are in the team's pipeline, with recommendations and concepts being brainstormed. These include a family of aircraft for different ranges to extend CH4llenger's capabilities of using alternative sustainable fuels such as hydrogen, designing a (e.g. parachute) system to recover the fuel tank after emergency jettison and how to be sustainably connected to isolated destinations.

