2 - Sailplane Pioneering Emission-free Aerial Recreation (SPEAR)

Global tourism came to an effective stillstand as a result of the COVID-19 pandemic. Nations, such as the Maldives, that are reliant on this industry experienced detrimental effects to their economy. Therefore they have to rebound with innovative tourist attractions to compete for visitors once restrictions loosen. With this in mind Trans Maldivian Airways (TMA), the largest air carrier in the Maldives, tasked the team of seven engineers to conceptualize and design an emission-free sailplane capable of take-off and landing on water.

Mission objective:

In discussion with the client the objective of the design is to design a proof of concept sailplane that provides aerial recreation for two passengers and one pilot. Aerial recreation being defined as a short flights of 20 minutes for the purpose of sightseeing. The SPEAR sailplane provides this service in a superior way to the current fleet of TMAs Twin Otters as the powered sailplane is far quieter, provides greater sightseeing abilities through the large canopy window, and provides and intimate outing for two passengers.

System Design:

Having completed a trade-off of design options for the aircraft's subsystem the following configuration was concluded: a self-launching (powered) sailplane, with a T-tail, floats, and high wing configuration. During the current detailed design phase the aircraft was sized, propulsion system was defined, the aerodynamic and hydrodynamic performance was characterized.

The aircraft was designed for a mission profile consisting of take-off, an initial climb to 1050 m, an initial powerless glide phase down to 150 m, a second climb phase back to 1050 m, and a second glide phase concluded by descent for landing. With this mission profile the initial wing planform was initially sized to have a span of 27.7 m and an aspect ratio of 25.2, providing a lift to drag ratio of 34.7.

By being a powered sailplane the aircraft is autonomous in take-off, as it does not require additional infrastructure such as a winch or additional aircraft. In order to remain emission free the propulsion system is a propeller driven by an electric motor. Making use of the best batteries available for aviation purposes, an energy density of 267 Wh/kg is attained.

To give an indication of how the aircraft would potentially look like, a model is provided in the image below.

Further developments for the proof of concept would be to scale the aircraft to allow for the transport of more payload given that the energy density of batteries increase. With this development the ambitious task of replacing TMAs Twin Otter fleet with an emission free option may be realized.