

Group 1: Clip-on Wings

If you want to travel to other major European cities, several transportation methods immediately cross one's mind. However, imagine that instead of using these methods, or getting trapped in long traffic jams, one can just drive away from home and then fly the major part of the journey. Our mission is to develop such a vehicle, namely: a faster and cheaper personal transport vehicle for the European market with detachable flight hardware that combines the advantages of road transport with flight capability.

This vehicle will both fly and drive in accordance with modern standards. It is able to drive and park like any luxury car, leaving the wings and tail at the airport. As a result, the ecological impact of producing the flight hardware, per flight hour, is decreased since it has a far higher utilization rate than normal general aviation aircraft. Furthermore, during the design special attention has been paid on the use of recyclable materials.

During flight you will be able to cruise for 556 km, at a speed of 296 km/h, whilst needing just 500m to take-off and land. This vehicle has an extremely low noise footprint through the use of Distributed Electrical Propulsion (DEP); there are a total of 18 propellers, leading to high redundancy. 12 propellers increase lift at low speed, whilst the 6 outboard propellers are optimized for an efficient cruise. The efficiency increase due to DEP will lower the energy consumption significantly. Furthermore, the propulsion system is highly innovative. The engine will run on E85 Bio-Ethanol, which is a very sustainable and clean-burning fuel. It consists of 85% renewable fuel from plant crops and agricultural waste, reducing the overall CO2 emissions and ecological impact by 70%. The hybrid drivetrain allows sizing the engine for cruise rather than takeoff, resulting in a lighter engine.

In drive mode, the vehicle will drive up to 100 km on its plug-in hybrid battery. The car is lighter than a subcompact car, with an empty weight of around 700 kg, leading to less wear and less energy consumption. When the generating engine kicks in to occasionally charge the battery, the driving range is boosted to over 2000 km. The Maximum Take-Off Weight is 1600 kg, including a payload capacity of three persons and luggage, thus a total payload weight of 360 kg.

During the past few weeks, budgets for the mass and power have been established. The car, control surfaces, and fuselage parts were sized and all structures were evaluated. A special automated linkage system to link the flight hardware to the car was also designed. This was partly inspired by train couplings, which requires no manual work and is performed within five minutes. A special model for evaluating the aerodynamic properties of the wing planform with DEP was set-up and tested. The propellers were designed in detail, to evaluate noise and efficiency. The flight performance of all flight stages and the stability and controllability were also evaluated and are within safe limits. During the last few weeks of the exercise, a final cost analysis and technical sensitivity analysis will be performed. A recycling plan and post DSE-activities will also be described. So far, the design is going well and the team is looking forward to the presentation of this state of the art vehicle at the 1st of February 2018.