Group 1 - Transwing eVTOL

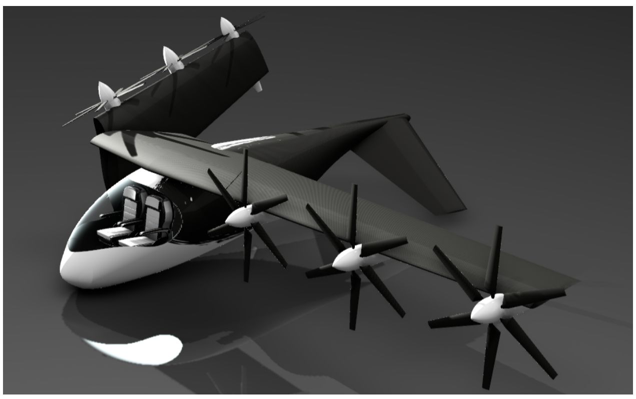
The decarbonisation of the aviation industry is of paramount importance for its future in a climate-neutral environment. The Urban Air Mobility (UAM) market, although still in its early stages, can be seen as a means for achieving so. It also provides the solution for many of todays problems, since it uses the third dimension of transportation while being flexible. As the UAM market focuses on zero-emission, low-noise, and low-ground footprint vehicles, it paves the way for the design and development of an electric Vertical Take-off and Landing (eVTOL) aircraft. The introduction of eVTOLs into society assists the transition to climate-neutral aviation greatly, more so with the advancement on the battery front, the performance of which used to be the bottleneck for eVTOLs - allowing for limited range and cruise velocities. Our design, the Swing, will introduce a novel technology to ensure a high-range vehicle for UAM.

Mission Objective

With such an emerging and promising market, many prospects are trying to enter the UAM market, however, they all lack a high range and low ground footprint combination. That is where the Swing transwing eVTOL comes into play, providing the perfect solution with a relatively high range of more than 100 km, while being able to land on four parking spots (8x4x2 m^3). This is realised by the innovative hinge design that connects the wing and fuselage, which enables the rotation of the wing in one rotation axis from the vertical configuration, during the vertical take-off and landing, and the horizontal configuration during cruise. Essentially transitioning from flying as a multicopter into flying as a conventional propeller aircraft, Swing would make use of the advantages of each configuration. Due to its adaptability and transformability, it can be used both as inter- and urban transport, airport shuttles and even last-mile delivery, which is its unique feature. Therefore, the mission objective is to "achieve sustainable inter-Urban Air Mobility with a low ground footprint vehicle".

System Design

To allow for the transport of four passengers and sufficient payload, while fitting within the constraints on overall vehicle dimensions, a high wing configuration was chosen and six propeller engines were used, each consisting of six blades. The engines are powered by electric batteries, located in the wing, releasing the bending moment and shift the centre of gravity aft. The downward v-tail ensures the stability and controllability of the aircraft and minimises the ground footprint during vertical flight (take-off and landing). Moreover, the v-tail encloses the landing gear for the vertical landing, conveniently placed, as well as reducing the drag significantly compared to the competition. Between the vertiports, the vehicle will follow a predefined mission profile, optimised for energy consumption and low block time. After vertical take-off until 100 m altitude, the Swing transitions the wings horizontally, becoming a conventional aircraft, to further climb to the cruise altitude of 500 m. After cruise, when the flight destination is reached, the vehicle descends and transitions back to the vertical state, after which it lands to the vertiport. To conclude, the mission profile is set to be flown completely autonomous, which has not been performed by competition for similar eVTOLS that all use piloted flight control. Therefore, this design will swing its way into the UAM market.



Swing transition of right wing