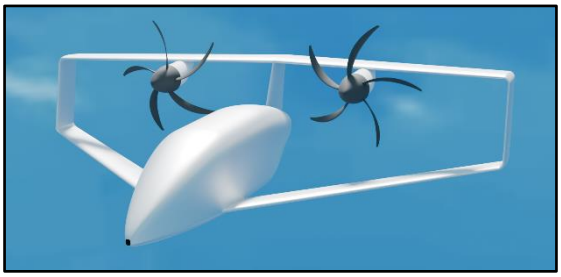
Group 26: E-Racer

The Pulitzer Air Race is an event that originated in the 1920s. The race was organised to promote the development of high-performance aircraft and to experiment with new designs. Similarly, to accelerate the advancement of high-performance, medium-range electric aviation, the National Aviation Authority (NAA) has planned to revive the Pulitzer Air Race for zero-emission electric aircraft. The race spans over four days and covers a distance of 1,000 nautical miles (1,852 km), from Eppley Airfield in Omaha, Nebraska, to Dare County Regional Airport in Manteo, North Carolina. The winner is determined by the fastest speed calculated from cumulative flight time, excluding ground maintenance, charging, or overnight stops.

The Royal Netherlands Aerospace Centre (NLR) saw an opportunity in the upcoming Pulitzer Air Race and wanted to participate in developing a sustainable electric aircraft. Group 26 taking part in the Design Synthesis Exercise (DSE) at Delft University of Technology was approached to deliver a proposal for a design that can participate in this race and win. As a result, the project objective statement for this project is to "Provide a winning design for the Pulitzer Electric Aircraft Air Race within a budget of €500,000, by 10 students in 10 weeks."

At the initial stage of the project, a market analysis identified the Sirius Business Jet, an electric VTOL aircraft using liquid hydrogen and set to fly in 2025, as the main competitor. This aircraft could participate in the Pulitzer Electric Aircraft Air Race and complete it without having to stop. From its specifications, the driving requirement derived was that the E-racer must have an average cruise speed of at least 145 m/s.

Once requirements and constraints were defined, five design concepts were selected over a wide range of potential configurations and a preliminary design for each one was made. Subsequently, a trade-off was performed to select the best design. Two of the design concepts ended up in a tie, those being the conventional aircraft configuration and the Prandtl plane configuration (or box-wing aircraft), both using hydrogen and batteries as energy sources. In the end, the Prandtl plane configuration was selected as the final concept not only because it embodies a spirit of innovation in keeping with the ethos of the race, but also because of its potential to be 36% structurally lighter than conventional aircraft configurations.



During the detailed design phase, intense concurrent engineering was performed between departments, with numerous iterations occurring throughout the detailed design process. The aircraft has a wingspan of 7.46 m, features two counter-rotating propellers driven by a continuous power of 88 kW each and an MTOM equal to 1,193 kg, of which 115 kg are due to the fuel cell, 30 kg of hydrogen mass and 53.5 kg of batteries. The Prandtl plane has a cruise altitude of 12.5 km, a cruise speed of 163 m/s and can complete the race without any stops in 216 minutes (slightly over 3.5 hours).

The team is currently finalising specific details of the aircraft and the overall mission, including race strategy, operations, logistics and risk mitigation, amongst others. A final report outlining all the details of the Prandtl aircraft and other related aspects will then be submitted. This will be followed by further organisational activities in preparation for the Symposium, which will be the culmination of the project.