

SUPERVISOR: Ir. Roberto Suarez Raspopov

Background:

In the last 10 years, the market of small flying vehicles such as drones has significantly grown. The main propulsion mechanism for these type of vehicles are propellers due to their superior thrust efficiency at small scale and lower flight speeds.

At the present, Inholland purchases commercial propellers for drones which are not necessarily optimized for the particular application of the vehicle. I.e. the characteristics of the propeller do not necessary match to the ones of the electric motor, neither to the speed and weight of the drone, nor the flying environmental conditions. This results in a reduced lift and higher energy consumption which leads to a shorter battery life. During a previous internship project, an Inholland student developed a computer platform to design custom made propellers. The propeller prototypes are currently fabricated using 3D printers and tested at the Innovation Studio.

The purpose of the present project is to improve to the previous propeller design methodology, to improve the manufacturing process (3D printer materials are brittle, so the propellers are prone to breaking) and to test the propellers under different operating regimes using the Inholland wind tunnel. By the end of the project the student should have developed a propeller design with higher lift and efficiency when compared to commercial solutions.

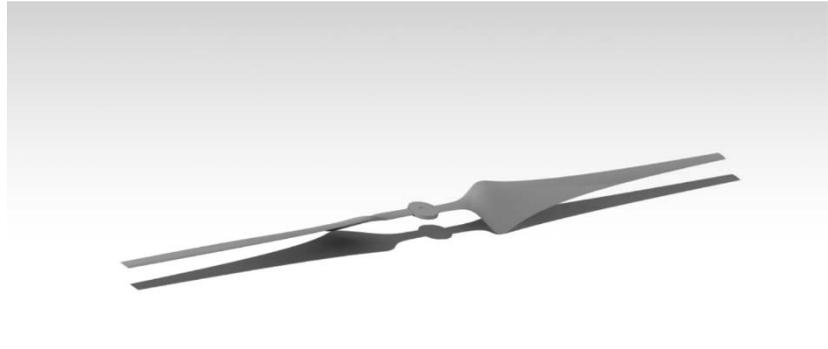


Figure 1: Improved propeller design created by Inholland student on a testing mount (left) and 3D render (right).

Proposed activities:

- 1) Review of propeller theory and familiarization with the MATLAB code **(1.5 month)**
 - a. Review and understand propeller theory and current methods for drone propeller selection
 - b. Understand the interaction between propeller and e-motor performance
 - c. Review, de-bug and implement detailed design methodologies in the existing Matlab code
- 2) Manufacturing process **(2 months)**
 - a. Review existing manufacturing techniques for small components
 - b. Improve the current 3D printing process of the propeller or come up with an alternative fast manufacturing process for strong and aerodynamic components
 - c. Print improved prototypes and perform tests on the bench available at the innovation studio
- 3) **Propeller testing in wind tunnel (1.5 months)**
 - a. Design a testing methodology/experimental setup for the wind tunnel located at Inholland and test different propeller designs to validate the design methodology.
- 4) Write report & present results

Student requirements:

- 1) Solid theoretical background in aerodynamics, propulsion, math and programming (MATLAB or python)
- 2) Good grades and sufficient credits for starting an internship
- 3) Proactive and capable to work independently

Interested students please contact Roberto Suarez for an interview/discussion.

Roberto.suarezraspopov@inholland.nl