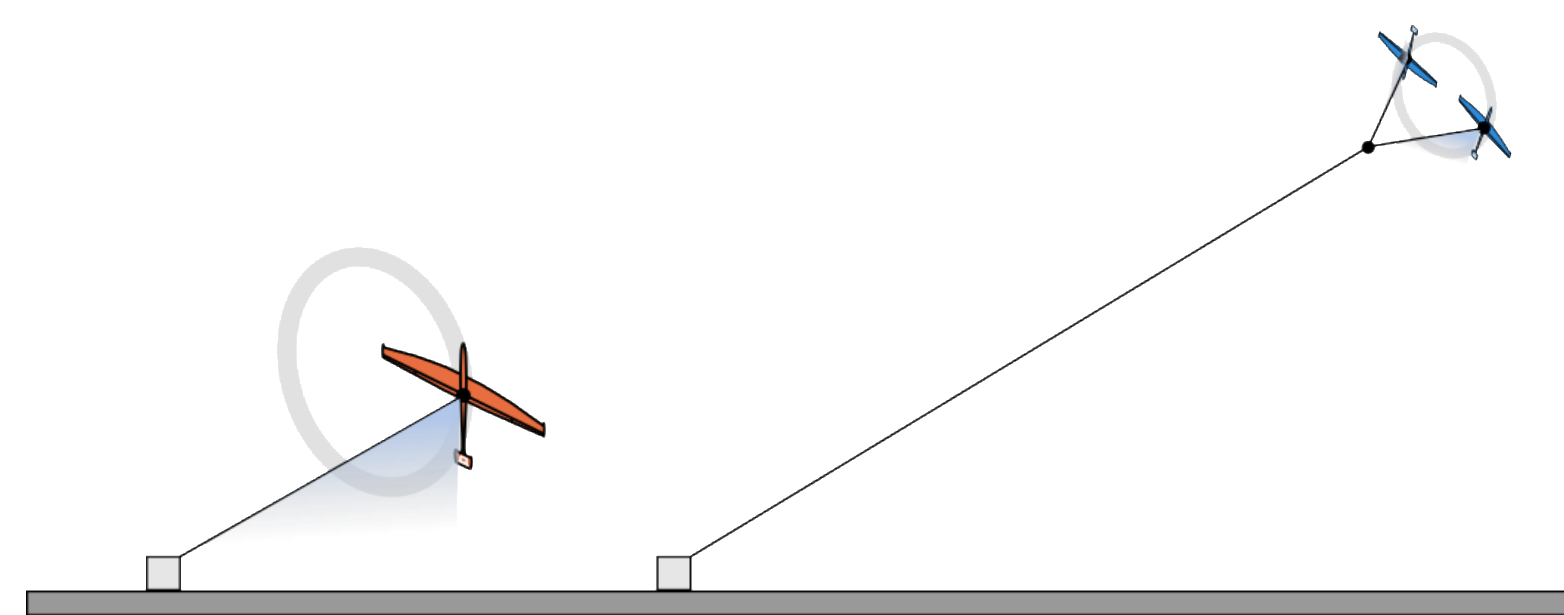


# The Multi-Wing Airborne Wind Energy Project

Jakob Harzer, Jochem De Schutter, Moritz Diehl, Kim Polkäser, Dieter Moormann

## Airborne Wind Energy (AWE)

- Generate energy from tethered drones flying fast crosswind manoeuvres at high altitudes
- Compared to existing single-wing systems, dual-wing systems are much more efficient but *have not been realized yet*



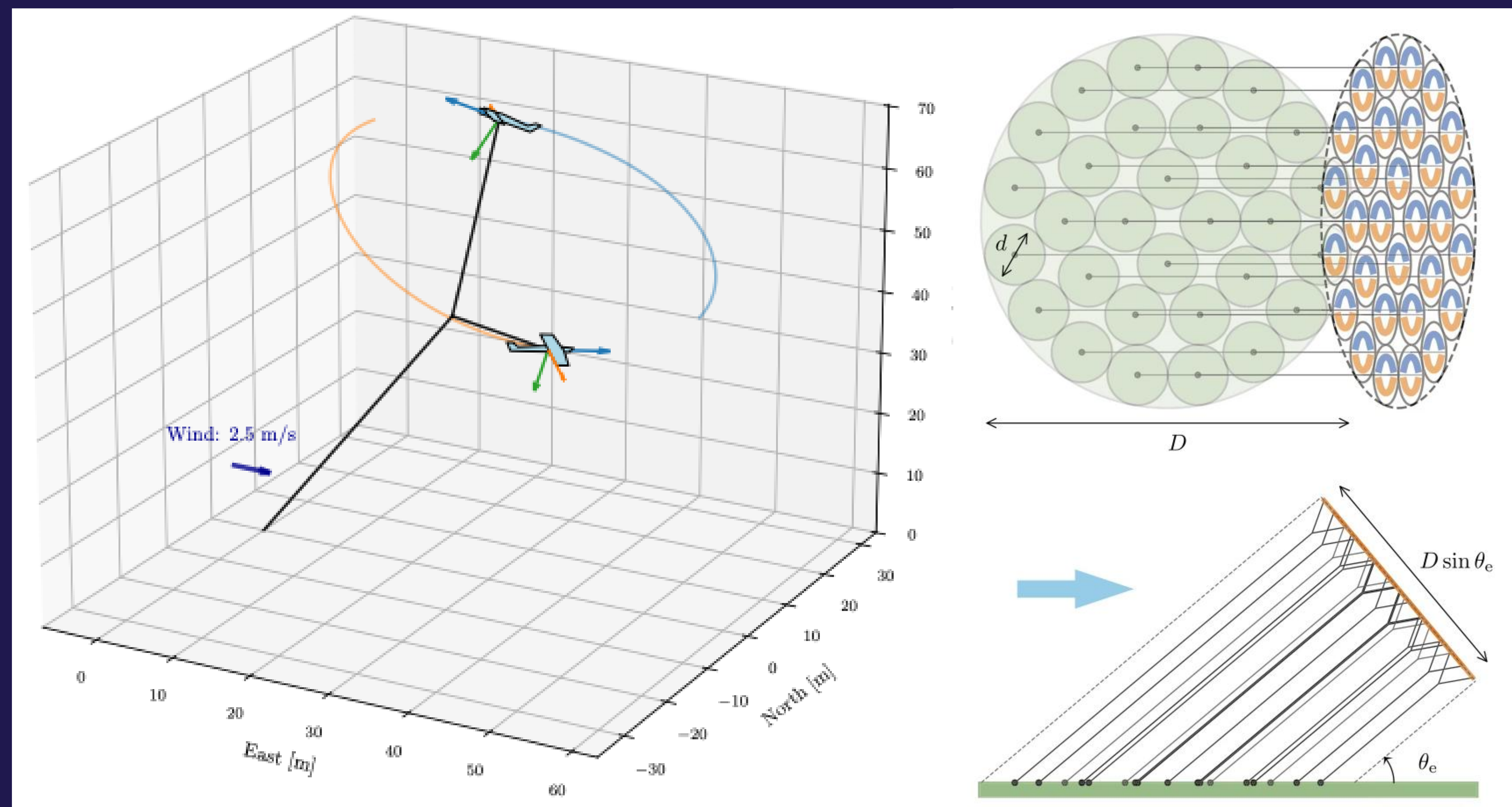
## Methodology

We formulate *optimal control problems* for questions on:

- Power-optimal flight trajectories,
- Safe flight operation under uncertain wind gusts,
- Individual system design,
- AWE wind farm layout,

which are then transcribed and solved using numerical methods.

# Optimal control helps to answer design, control and economic questions of dual-wing airborne wind energy systems



Left: Optimized trajectory for the planned dual-maverix system

Right: Optimal design for an AWE wind farm with high power density per ground area [1]



Download the poster

Cooperation with RWTH Aachen's Chair of Flight System Dynamics (FSD)

- Goal: Implement a prototype of a dual-wing AWE system using FSDs 'Maverix' flight system



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From a recent project meeting, left to right: Felix Renard, Florian Messerer, Prof. Moritz Diehl, Jakob Harzer, Kim Polkäser, Dieter Moormann

## (Some) Related Publications

- [1] "Vertical Airborne Wind Energy Farms with High Power Density per Ground Area based on Multi-Aircraft Systems", J. De Schutter, J. Harzer, M. Diehl, European Journal of Control (2023)
- [2] "Numerical Trajectory Optimization of Airborne Wind Energy Systems With Stroboscopic Averaging Methods", J. Harzer, J. De Schutter, M. Diehl, IEEE Control Systems Letters (2025)