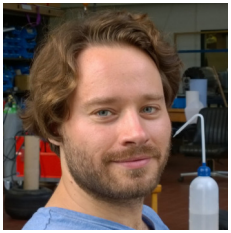
Mobile development platform EK30 (November 2016)

EnerKíte V-wing EK202 in flight (July 2017)



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Comparison of Launching & Landing Approaches

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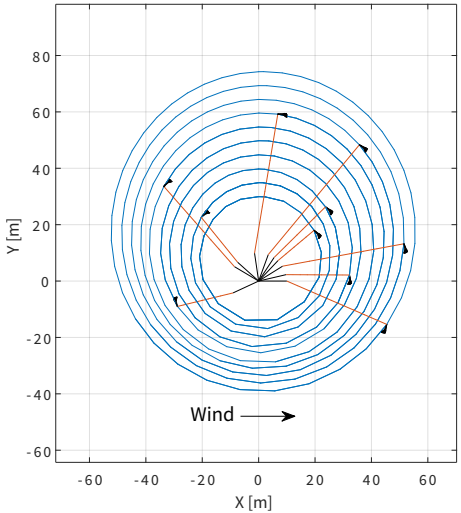
The market entry and success of airborne wind energy systems hinges on the capability of reliable, scalable and cost efficient launch and landing technologies. A conceptual analysis and comparison of the three currently favored approaches vertical take-off, catapult and rotating arm is presented. This analysis estimates the different masses and powers necessary both airborne and on the ground and it reveals the scaling effects with respect to different power ratings, wing sizes, weights and the concerns due to economic, safety and process complexity arguments. Particularly, the effect on low nominal wind speed designs of added systems to the wing are discussed. From this comparison, the choice at EnerKíte for a rotating arm is motivated.

For the onboard propulsion variants, simple formulas and comparisons to existing technologies are utilised that are similar to the analysis in [1]. For the rotating arm, an additional in-depth analysis shows the theoretical development stages within the last years at EnerKíte. From geometric formulas for rough power and sizing requirements, over point mass models and optimal control results, and up to detailed simulations for a semi-rigid EnerKíte wing. This analysis underlines the results of the general comparison and illustrates the viability of the development path of the launch and landing system at EnerKíte.



Example of a detailed look at the rotating arm. Periodic trajectories with increasing line lengths at 6 m/s wind speed during rotation. Optimal control result with the aim of minimal change in angle between arm and kite and simple torque control functions. Note the asymmetric trajectories due to the wind direction and magnitude.

References:

[1] Fagiano, Lorenzo, and Stephan Schnez.: On the take-off of airborne wind energy systems based on rigid wings. Renewable Energy 107 (2017): 473-488.

EnerKíte