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## Kitemill's Vertical Take-off and Landing System for the KM1 Model

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There are many different launching systems for airborne wind, ranging from catapult launches, spiral launches and vertical take-off and landing (VTOL) solutions. After a thorough analysis, Kitemill found VTOL to be the best means for launch and recovery of their kites and has invested much time and effort to develop an autonomous VTOL system for airborne wind leveraging the research within drone technologies.

The KM1 model called the Spark model has a wing span of 7.4 meters, and four different motors, two large motors fixed to the fuselage, and two smaller motors on the wings that can be tilted to produce a forward thrust to enable a transition from VTOL mode to production mode. The tilt-motors can also be used in regenerative mode to enable recharging of the batteries onboard the kite during the return phase to enable 24/7 continuous autonomous operation. In addition to the four motors, the kite has multiple control surfaces that work together with the motors to control the kite in high wind conditions.

This work presents how the combined sets of actuators are used to control the attitude and altitude of the kite, how to reach a desired position through a novel guid-

ance strategy specifically designed for airborne wind energy systems that minimizes the required power, how the team has developed and tested the system, as well as the experiences obtained through this work. Experimental results show the performance of the system.



*Experimental testing of the VTOL system for the KM1 model.*