

Improving Multirotor Efficiency and Flight Times

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Multirotor UAVs are quickly becoming popular with everyone from photographers to backyard hobbyists alike. A major drawback of current multirotors is their short flight times caused by inefficiency. The purpose of this project is to increase efficiency and flight times by determining the most efficient propellers for use in the static air conditions encountered in multirotor flight. I collected a set of six of the most popular off-the-shelf propeller choices used for multirotors today and determined the most efficient using two experiments. The propellers were carefully selected as to have the same diameter and pitch, only the designs were different. My research suggested that propellers engineered with lightweight materials and wider chords would perform better than other propeller designs. In the first experiment I built and used a custom test stand to measure the thrust(g) to power used(watts) ratio of each propeller type. The second experiment measured flight times of a specially constructed quadcopter using each propeller type. The results of both experiments confirmed what my research suggested in that the propellers made of lightweight carbon fiber coupled with a wide chord were the most efficient. Since the propeller was constructed using carbon fiber, it achieved the necessary stiffness with a significantly thinner airfoil resulting in less drag and increased efficiency. The wide chord of the propeller prevents the propeller blade from stalling towards the hub. The results of my experiment can be used to design more efficient propellers specifically designed for multirotor use.