Theoretical Evaluation of Using Solar Power to Increase Drone Flight Time

Ian G. Green and Martin L. Tanaka PhD

College of Engineering and Technology, Western Carolina University

Drones are used in many places including cinematography, sports broadcasting, and military reconnaissance. As a relatively new product, there is high potential for the development of innovative technologies. Although they are used in many places, it is surprising that drones have a relatively short flight time, about 30 minutes. The purpose of this project was to determine if solar cells attached to a drone can be used to prolong the flight time. A computational model was created to explore this topic. The model was based off a consumer grade drone, the DJI Phantom 3 Standard. The chosen solar cell was the Sunpower C60 solar cell. Adding solar cells adds weight, so the number of solar cells that would completely prevent the drone from flying, due to added weight was calculated. These weights, along with the coefficient of lift and the specified force of the motors, were used to find the power needed to fly the drone at its new weight. Using this power consumption, the battery life for the drone was calculated. The system was modeled at 100%, 50%, and 0% solar cell output to account for shade resulting from clouds or low light that may occur in the evening. Based off these calculations, the Phantom can hover indefinitely with 50 C60 solar cells at full power or with 127 cells at half power. Assuming there is no power being produce by the solar cells, it will drop the flight time down to ~24 and ~19 minutes for 50 and 127 solar cells, respectively. Increasing drone flight time would especially benefit the scientific field, where greater airtime could greatly increase the amount of data collected. The cinematic industry would also benefit from a longer flight time.