Optimization of Solar-Powered and Continually Sustained Flight in Unmanned Aerial Vehicles for Variable Mission Criteria

Feasibility analysis using Mathematical optimization of solar-powered aircraft using first principles for different mission cases.

Section.1 Abstract

This dissertation has proven that continuous and theoretically infinite solar flight for unmanned aerial vehicles (UAVs) is feasible through the use of a parametric mathematical model in the sense that it is; firstly physically possible as the physical constraints of the universe and the laws of the first principles physics are obeyed; next, practically viable in the sense that it uses current data from existing technologies; and lastly relatively economically viable in the sense no research-grade solar cells, batteries, and materials are used to determine the parameters input into the master model.

This conclusion is reached by establishing first principles physics regarding the mechanics of powered flight, which allowed for the establishment of a robust set of mechanical constraints and parameters. After that, first principles physics regarding solar powered flight was established to determine the energetic constraints and parameters of the mathematical solar aircraft.

These two chapters resulted in the following two outcomes: first, first principles physics regarding the mechanics and energetics of solar-powered flight gave context on how to create a parametric mathematical model; and second, a set of takeaway points at the end of chapter units helped guide the creation of the mathematical model in ensuring no parts of the mathematical solar craft are neglected thereby ensuring a high level of conclusivity

After the initial two chapters, sets of individual models were created to model the various systems of the solar aircraft, such as the mass of the batteries, area of the wings, power consumed by the avionics, etc., in Chapter 3.

Chapter 4 involved the drawing up of the “master” or grand model to link all the previously uninterfaced models from Chapter 3 into one large parametric model. This master model was then used in conjunction with the parameters of current-day and widely available technology (such as batteries, charge controllers, solar cells, etc.) to determine that continuous and theoretically infinite solar flight for unmanned aerial vehicles (UAVs) is feasible concerning the three aforementioned aspects.