Abstract

This should be an abstract of the project. This is probably the last thing to be written in the report.

The goal of this project was to create a drone that would encompass a buoyant helium balloon in order to reduce the amount of power needed for the motors to maneuver and for the drone to hover, resulting in a longer flight time. Our client, Jonathan Glen from the United States Geological Survey, who was contacted through Professor Mircea Teodorescu and graduate student Gordon Keller, gave us a number of requirements for the drone, including remote control and autonomous functionality, a 30 minute normal autonomous flight time, a minimum drone speed of 5mph under 15mph wind conditions, and a magnetic field interference of less than 10 nanoTeslas from the motors to a magnetometer payload carried by the drone.

The drone was made from scratch, with parts needed to be 3D printed, sewed, or ordered online. Sensors were ordered to be put on the drone, while a microcontroller and microprocessor were to be coded in order to read from and analyze the sensors through a printed circuit board that would simplify the wiring of our entire system. A control system was created for the autocorrection of the drone with the microcontroller, since the drone was not meant to tilt like regular drones. It is instead maneuvered by four motors each attached to a two directional rotating servo. A simulation was created to test the remote control and autonomous functions, as well as the physics of the drone. Power testing was done for each part individually to verify the flight time with a selected battery.

The physical fabricating, manufacturing, and testing of the drone was met with some errors. The envelope that would encompass the helium lift bag of the drone was misshapen, resulting in a drag force that is too powerful for our motors at the minimum drone speed. A test flight could not be completed due to mistakes in the process and could not be continued due to long shipping delays. The autonomous function of our drone was not able to be completed and the printed circuit board also had unfixable errors.

(Successes here or already too long?)

Research data collection with drones has become invaluable and enabled researchers to collect more accurate data faster than ever before, even in areas that could not normally be accessed. Unmanned multicopters are used to carry payloads and collect data, but they are limited to short flight times. The USGS collects magnetometer data with multicopters, but are limited to 15-minute flights, limiting the amount of data they can collect on a trip. We have partnered with Jonathan Glenn of the USGS to identify the needs of researchers and have worked to extend their drone flight time. Since drones expend most of their energy counteracting their own weight, we implemented a helium lift bag to reduce the drone’s and payload effective weight to 4N and increase flight time. The primary project goals developed with USGS were a minimum drone flight time of 30 minutes, a reduced magnetic field to decrease magnetometer interference to less than 10nT, a 20-mph minimum airspeed, and legal compliance with the FFA, with both Remote Control and Autonomous Control Functionality. Magnetic interference was never verified, legal compliance is achievable, but needs a completed drone to fully apply, and Remote Control and some autonomous functions, but not the full autonomous system, were verified in MATLAB. In the end, due to manufacturing errors the drone test flight never made it off the ground, but power draw analysis verifies a 40-minute flight time can be reached with a 20mph airspeed. The project was unsuccessful in meeting the USGS’s needs, but simulation and power draw analysis show the design is possible and worth pursuing.