ME 424 X-Prize Team Hydra: Hybrid gas electric power for Drone/UAS

Supervisor Meeting #1

**Overview:**

The Shell Ocean Discovery X-Prize is a competition to autonomously map the ocean floor. The Duke team, sponsored by Martin Brooke, is attempting to do so using sonobuoys deployed via drone. The drone features triple redundant flight systems, 18 rotors, and a hybrid gas-electric power system. The hybrid power system utilizes the high energy density of liquid fuel over batteries to provide the electric power for the 18 rotor hover drone, greatly extending flight time.

**Team Mission**:

Previous groups have proven the concept behind the hybrid power system. Our senior design group will characterize the performance of the existing hybrid gas-electric power system, improve upon current design, build three independent power systems, and mount the systems to the drone. After mounting the power systems, we will perform flight tests to prove efficacy and reliability of the system.

**To-do list**:

1. Become familiar with the existing engine setup, make sure it still runs.
2. Measure the efficiency of the engine/generator combo. Current estimate is at 10%, but we need to find the actual efficiency in the two-stroke’s power band for flight time estimates.
3. Duplicate the current engine system, hopefully using the new ESC/Arduino/Rectifier our ECE group member designs.
4. Design engine mounts. Weight is critical. Structural rigidity is also important to maintain shaft alignment.
5. Test the engine mounts both on and off the drone to ensure geometric compliance and that the weight is low enough.
6. Run flight tests to ensure drone flies with three engines. Experiment with flight time and lifting capacity.

Minutes- 1/23/17

1. Make sure the existing can still work (1-1.5 weeks)
   1. Measure efficiency at resonance conditions (and find those operating conditions)
2. Make two extra engine-motor setups
   1. Duplicate the existing setup
3. Design engine mount frame (1.5 months)
   1. Lightweight
   2. Reliable
   3. Mounts three engines on one drone
4. Flight tests
   1. One engine, temporary mounts?

**Mission Reqs:**

1. Ten pound carrying capacity
2. Some redundancy

Overall Goals

1. Build a power system for a drone

Things we need to do to get there:

1. Run the existing setup
   1. Test the existing setup for efficiency
   2. Understand the system operation
2. Research alternative designs
   1. Efficiency estimates
   2. Reliability
   3. Power output meets reqs
   4. Try and sell Brooke on the idea