Sooner Rover Extreme Delivery Mission Drone

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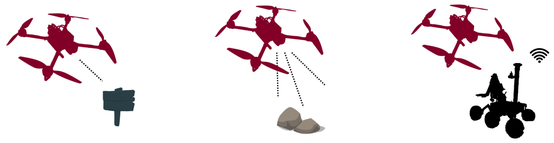
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Background

Sooner Rover is a multidisciplinary engineering student competition team designing a mock-Mars rover.

The **University Rover Challenge** (URC) is an international competition held in Utah with **four missions.** This drone will assist in the **Extreme Delivery Mission**.

Objectives



Read Sign | **Survey Terrain** | **Improve Comms.**

URC Constraints

$1K Budget | **2.4 GHz Comms.** | **Mass ≤ 5 kg** | **Desert**

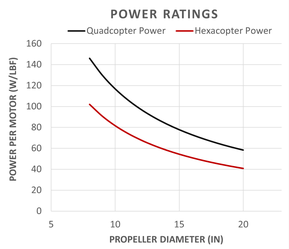
Engineering Standards

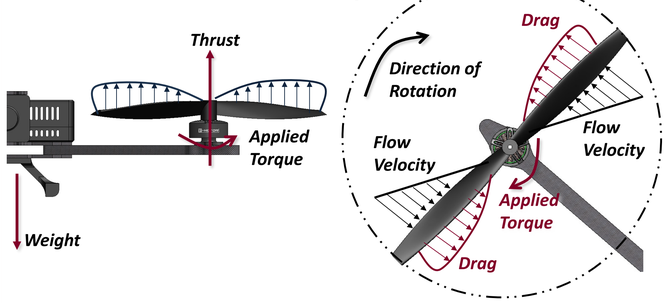
Compliance with FAA 14 CFR Part 107 (≤ 55 lb. MTOW) and 49 U.S.C. §44809 recreational UAS exception, along with ASME Y14.24 standards, was maintained.

Initial Sizing

Initial drone sizing defined constraints for battery, rotors, and actuators:

- **Thrust-to-Weight Ratio** > 1.5 to prevent stall
- **Maximum takeoff weight** < 5 kg
- **High energy-density battery** required
- Rotor size and RPM optimized for efficiency using **Power Ratings** chart
- Hover power and endurance estimated via **actuator disk theory**



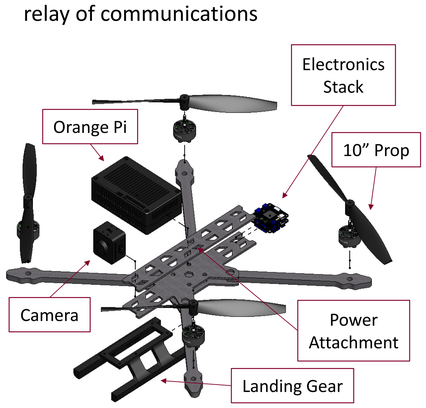


System Architecture

The drone system is designed to **extend rover capabilities** by combining aerial sensing, real-time processing, and reliable communication.

- **Pilot commands** are transmitted via 2.4 GHz link to the flight controller
- The flight controller, running PX4, **stabilizes the drone** and drives motor outputs
- A companion computer **processes camera data** and **manages video streaming**
- **Live video and telemetry** are sent back to the base station for operator awareness
- The drone enables aerial scouting, target identification, and relay of communications



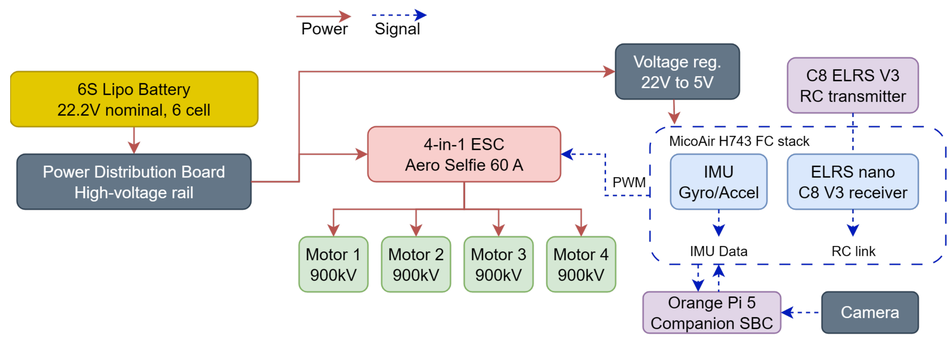




Electrical Configuration

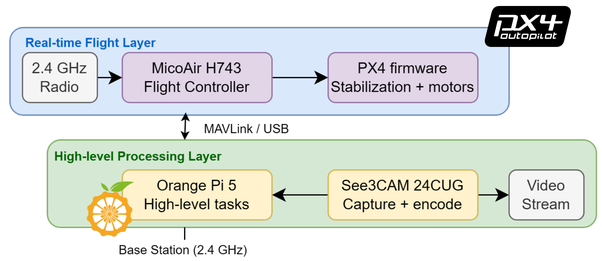
The power system is designed around a 6S LiPo battery supplying the propulsion and onboard electronics.

- **6S LiPo battery** provides the main high-voltage rail directly to four 60A **ESCs**, which drive the **brushless motors** via Pulse Width Modulation (PWM)
- Voltage regulator steps down battery voltage to a **stable 5V rail** for the Orange Pi 5, flight controller, and peripheral electronics
- ESCs are rated at **1.5x peak motor current** to prevent overheating under load



Control System

The drone uses a **two-layer software architecture** separating real-time flight control from high-level processing.



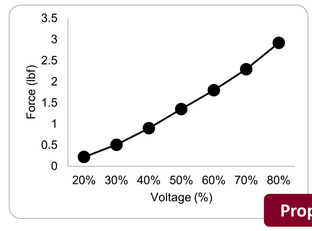
This modular design **improves reliability** and allows **future autonomous features** to be added.

Testing

Initial testing focused on **validating propulsion performance** using **a single-motor test stand**.

- Measured **rotor thrust**, **current draw**, and **voltage drop** using static test stand
- Generated **thrust vs. power** data for system characterization
- Used results to **verify propulsion sizing** and performance estimates

Full system- testing will include controlled flight tests to evaluate stability, endurance, efficiency and communication performance.



Propeller Lift Study



Conclusion

Future development of the drone will focus on **improving reliability** in the field and **more rigorous testing**.

Documentation Handoff → Field Reliability Testing → Semi-Autonomy

Acknowledgments

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