Autonomous Rocket Recovery System

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Steering a Payload

- Uses real-time data to navigate its way to a targeted location.
- The payload is released from 3,000 feet in the air before apogee of a rocket launch. post deployment.

Project Goal

To design a system of **automatic recovery** for a **payload** inside a rocket, providing a basis for future **autonomous full-rocket recovery**

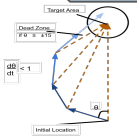
Navigation

[1] IMU obtains directional vector (v^1) by reading the heading of the payload using the magnetometer

[2] GPS reads the current location of the payload

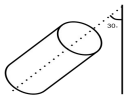
[3] The onboard pi calculates the angle between the two vectors.

[4] Linear actuators move to steer the payload



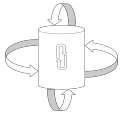
Deadzone

If the payload is within 15 degrees of the target vector, the payload will continue in the direction it is going to prevent overcorrection



Tilt Correction

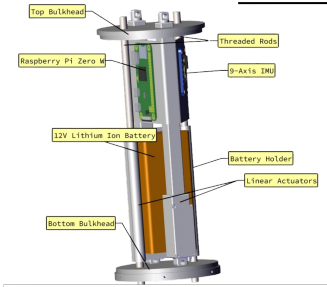
If the payload is tilted over 30 degrees from the vertical axis, data will not be collected, to prevents errors due to stability



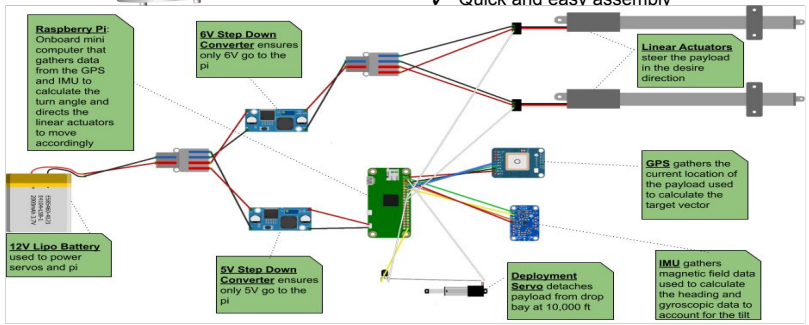
Calibration

Software allows for automatically calibration of the IMU to correct for bias

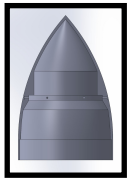
Overall Payload Design



- ✓ Fiberglass bulkheads ensure **radio frequency transparency** and **strong support**
- ✓ **Threaded Rods** and **linear actuators** provide **vertical reinforcement**
- ✓ Electronics attached to outer perimeter of **3D-printed sled** so wires do not block RF communication
- ✓ **12 Volt 2200mAh LiPo battery** attached to PLA bracket with **velcro**
- ✓ Quick and easy assembly



Nose Cone



- Korekau is attached to the Nose cone.
- When the payload detaches from the launch rocket, the nose cone will detach from the rocket alongside it.
- The nose cone will protect the payload from any heavy impact.

Results

Starting at intramural field 3 in the bottom right the payload successfully navigates to intramural field 1 in the top left covering a distance of over 0.5 miles

Failsafe

In the event of navigation failure, the paload enters its failsafe protocol and pulls on one end of the parachute causing it to spiral downward.

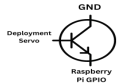
Drone Testing System

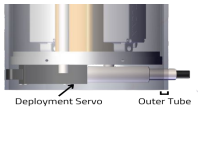
Phase 1

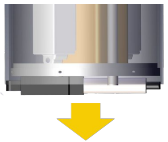
A **PLA Outer Tube** encases the payload. The **Deployment Servo** is left extended, The **carbon-fiber-framed drone** attaches to the top of the Outer Tube, flying **400 feet** in the air.

Phase 2

At 400 feet, a **GPIO pin** on the **raspberry pi** to send a signal to the emitter pin on the transistor causing the servo to **contract**. The entire payload navigates itself to the desired location.







Future Plans

- Launch the payload from Hermes a second time to ensure correctness of design and algorithm..
- Apply the algorithm to a mechanical design for full-scale rocket payload, in order to enable fully autonomous recovery of rocket payloads.