

# MARS SAMPLE RECOVERY SYSTEM

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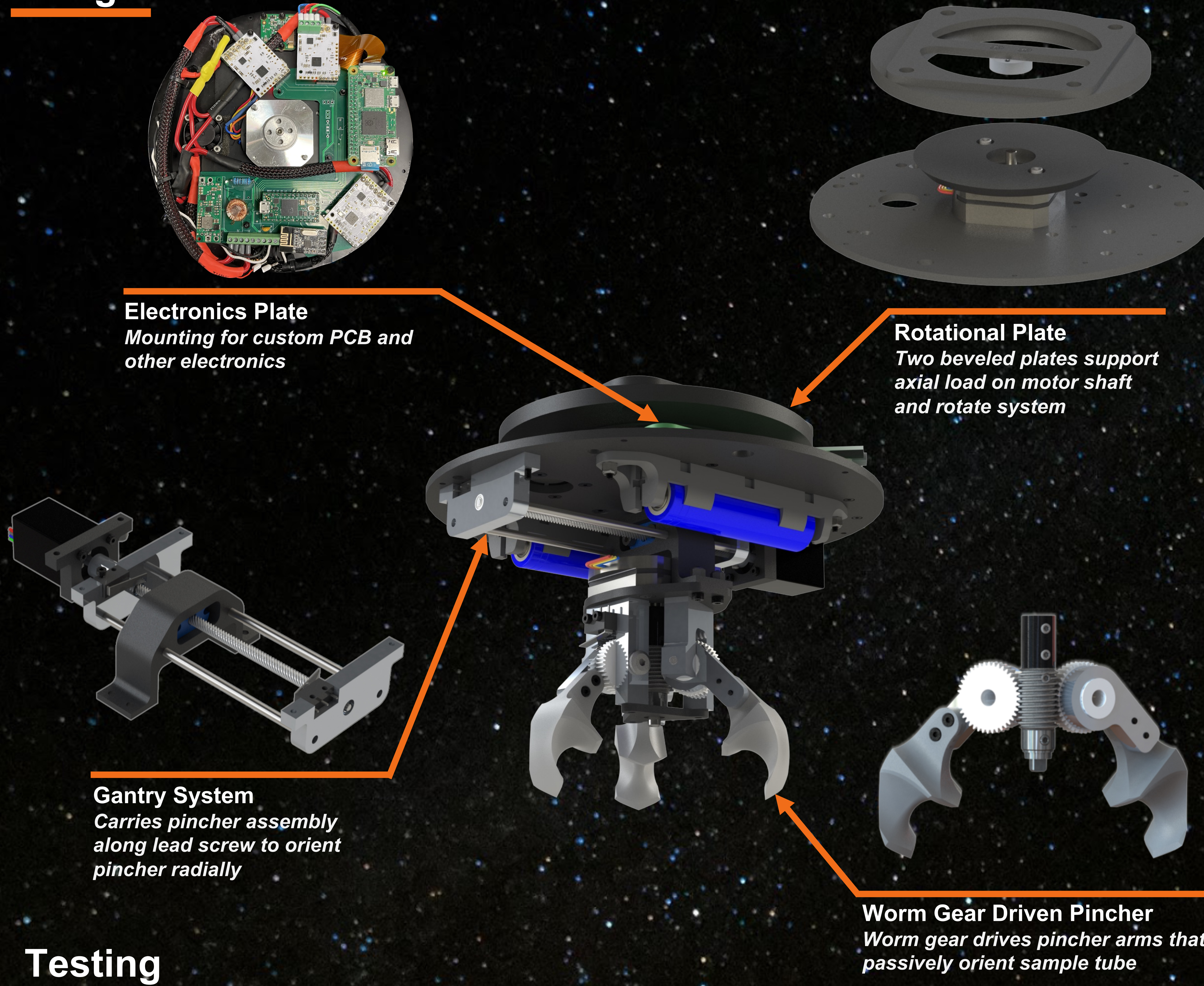
## Background and Motivation

- Perseverance Rover is currently caching sample tubes of Martian rock and regolith on the Jezero Crater of Mars
- Designed an Earth-based prototype of a Mars Sample Recovery System for a drone to help collect samples deposited by Perseverance

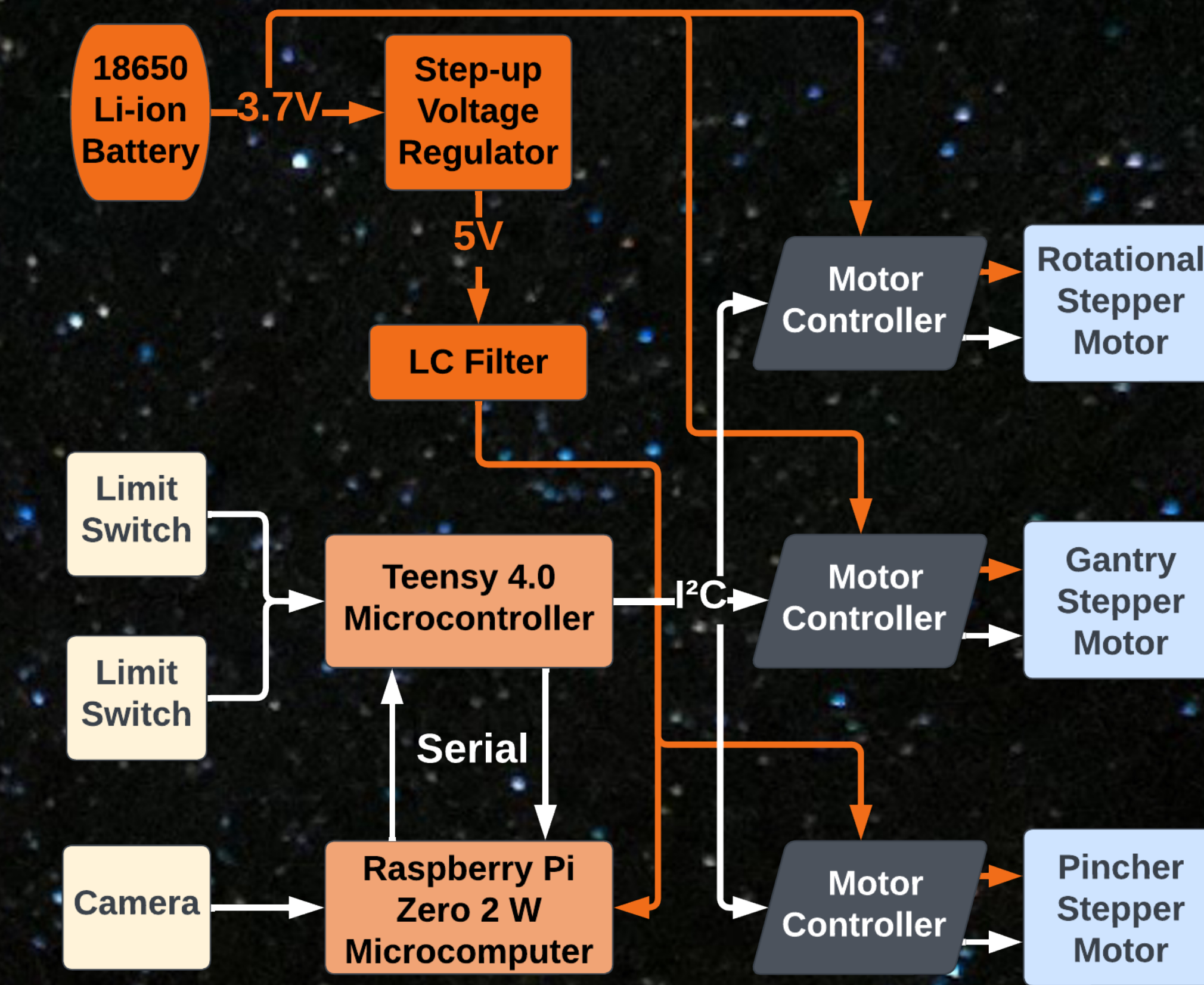
## Mission Objective

- 
**Perseverance Rover**  
 Deposits sample tube on the surface of Mars
- 
**Ingenuity Helicopter**  
 Flies to the tube and lands overtop the sample
- 
**Sample Recovery**  
 Locates and retrieves sample tube
- 
**Mars Ascent Vehicle**  
 Ingenuity Helicopter delivers sample to Ascent Vehicle for return to Earth

## Design

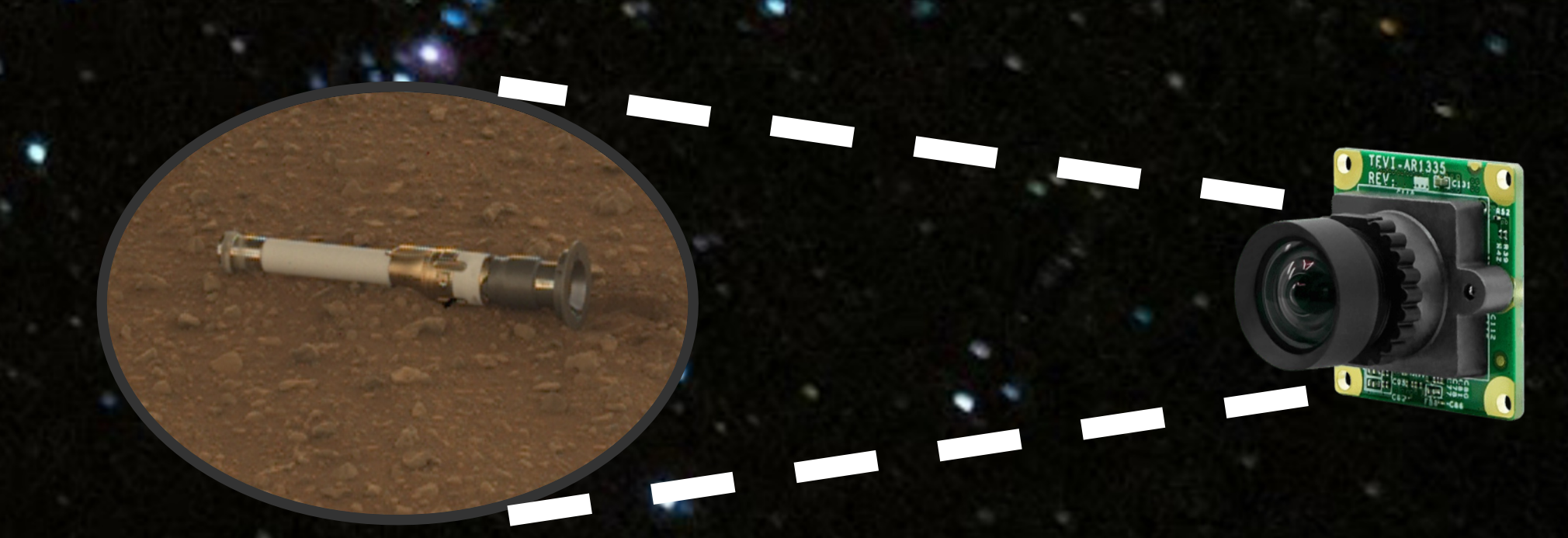


## Electronics



## Automation

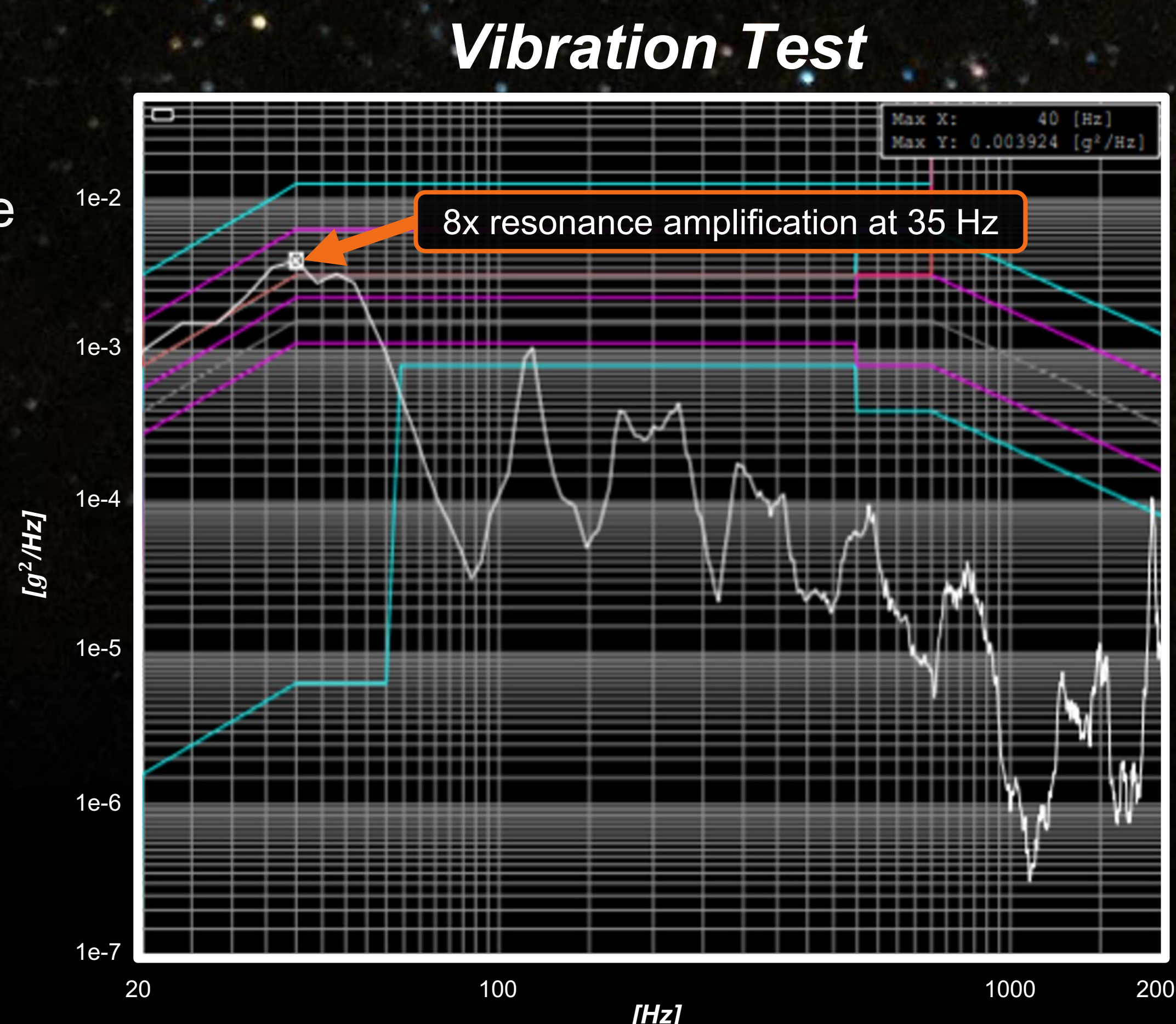
- Camera captures pictures of pickup area to locate sample tube
- Raspberry Pi determines coordinates of tube with vision system
- Raspberry Pi sends coordinates to Arduino, which moves the motors to grab the tube



## Design Specifications

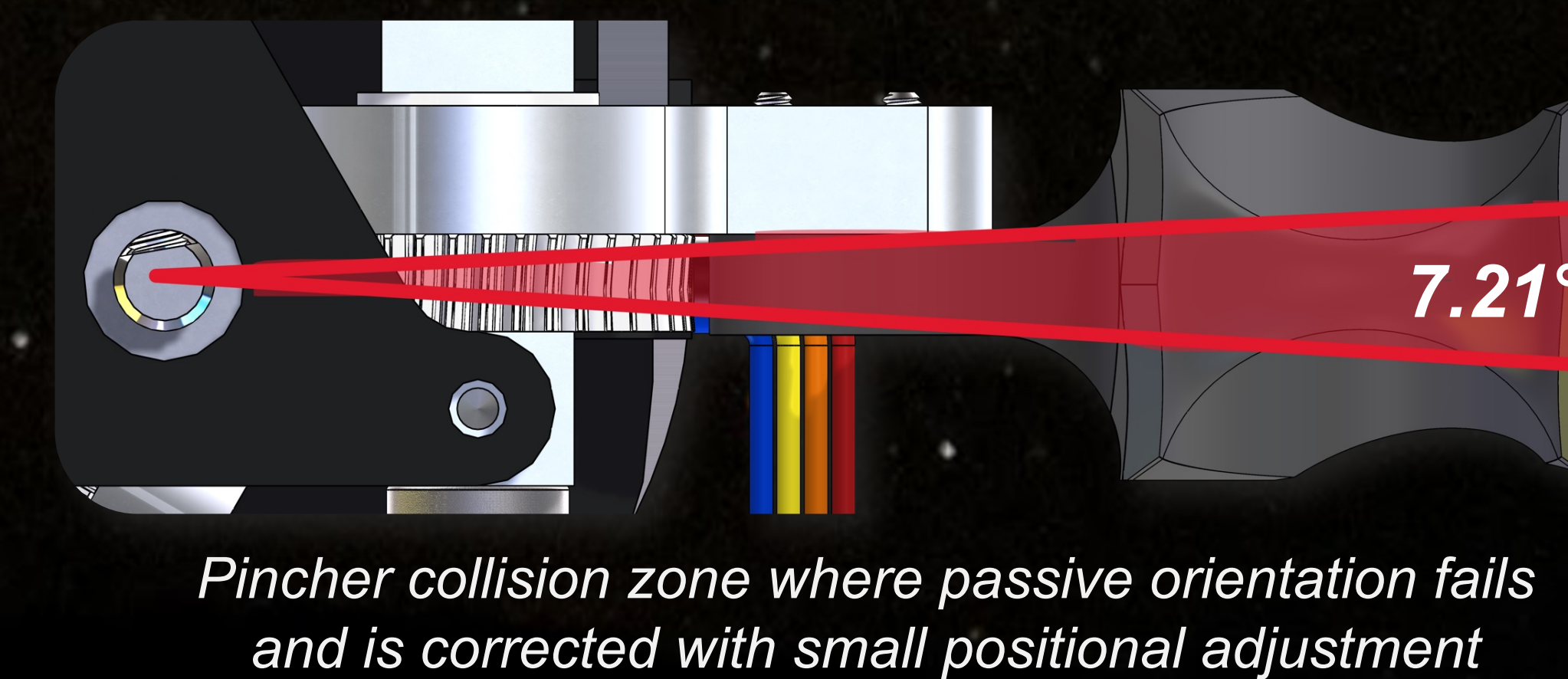
- Mount to the bottom of a DJI Phantom 3 Drone
- Actuate in multiple planes and directions for sample retrieval
- Locate and secure sample tube in any orientation within the pickup radius
- Perform accurately and repeatably
- Safely secure sample tube for flight

## Testing



## Functionality Testing

- 105.67 mm (4.16 in) pickup radius
- 2-minutes or less pickup time
- 94% Successful pickup rate



## Scalability to Mars

- Replace low-cost materials for Titanium and Ultem 1000
- Introduce Z-axis actuation for variations in terrain
- Add dust mitigation to protect systems
- Conformal coating for PCB and electronics
- Introduce Heli-Coil thread inserts to lock in fasteners