NASA USLI
Payload GRAPPLER

Ground Retention Apparatus & Polly Pocket Living Enclosed Residence

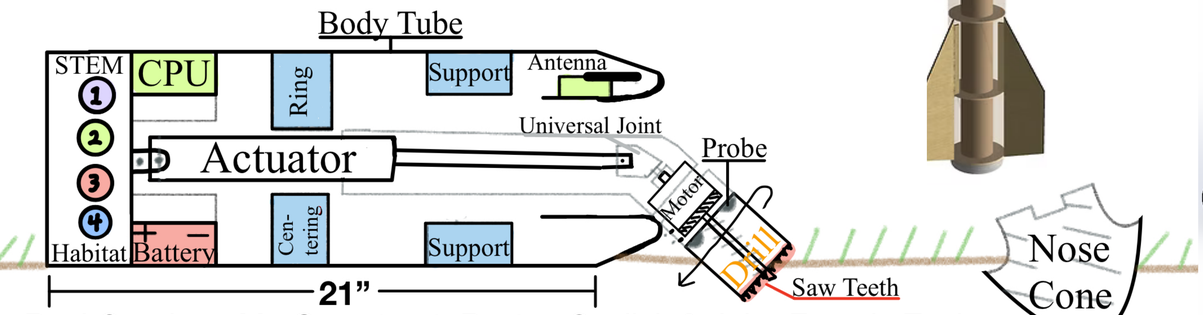
Problem Statement

Interface with the Rocketry Club at UAB to design a payload for their rocket that can withstand takeoff, flight, separation, and touchdown. The payload has to be capable of doing the following:

- House 4 STEMnauts in an atmosphere isolated environment
- Collect at least 50 milliliters of soil
- Test and transmit soil conductivity within 15 minutes of landing
- Must be reloadable & repeatable

Constrains and limitations

- **Weight Limit:** Maximum of 5.8 lbs.
- **Space Limit Dimensions:** Must fit within 21” long by 3.8" diameter cylinder with some additional space in a custom nose-cone
- **Autonomy:** Collect, analyze, and retain soil then transmit resulting data within 15 minutes post-landing
- **Energy & Power:** Isolated, low-power design to fit within available onboard battery capacity
- **Safety Compliance:** Uphold NASA USLI safety guidelines for mechanical and electrical systems
- **Environmental Considerations:** Minimize contamination, material waste, and ensure sustainable repeatability
- **Soil condition variability:** Unknown moisture content that will affect penetration forces





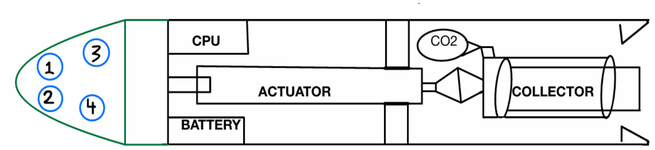
Alternate Design I

Pro:

- Potentially lighter design with fewer moving parts that requires no heavy electrical motors

Con:

- More complex and higher risk of failure with the CO2 and a limit of one shot to collect soil

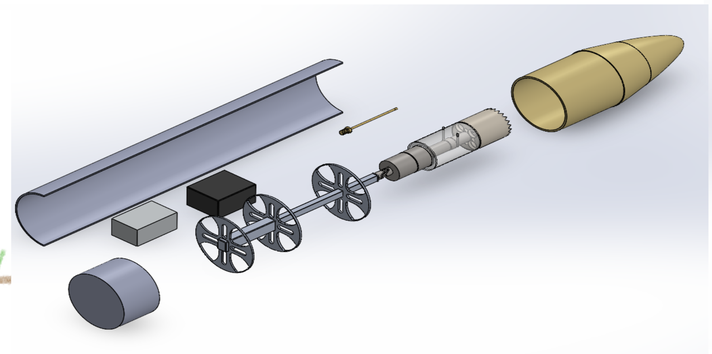


Final Design and Justification

Main Parts: Linear actuator, universal joint, high torque motor, collection container, auger drill, hole saw, electrical conductivity probe

Justifications:

- Universal joint solves the issue of orientation landing
- Linear actuator produces needed force to eject nose plug while deploying and retaining soil collection unit
- High torque motor and hole saw allows enough force to successfully dig into ground with hole saw
- Auger drill will pull needed 50 mL of soil into collection container for data testing
- Electrical conductivity probe utilizes nichrome wire to guarantee accurate readings



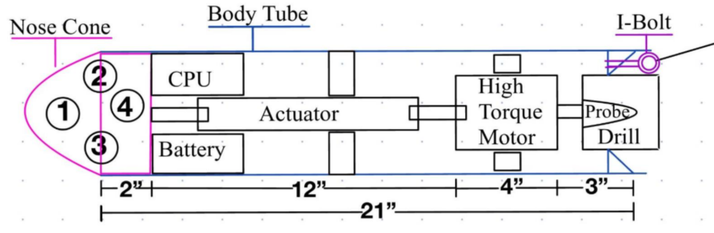
Alternate Design II

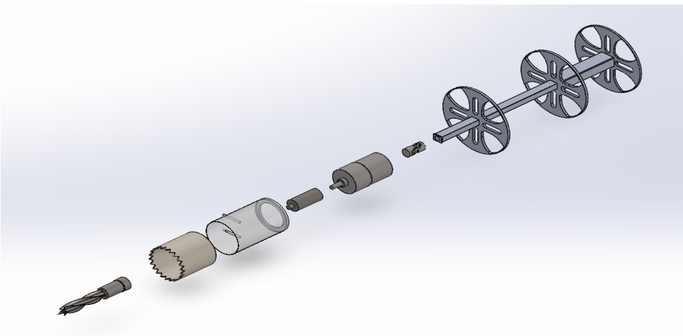
Pro:

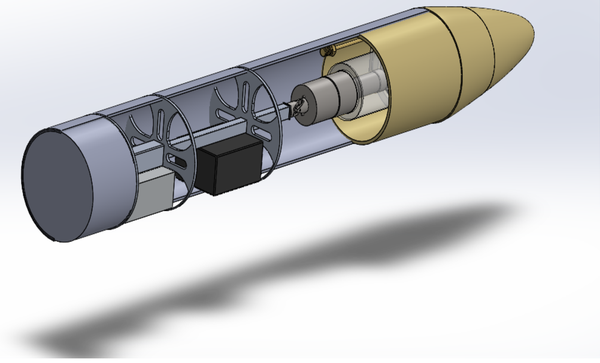
- Position of STEMnauts into cone section would be beneficial to optimize limited space

Con:

- The position of the eye bolt connected to the parachute would create an entanglement issue during soil collection







Paul Goodner, Mo Overstreet, Peyton Scalisi, & John Francis Zech