P22763: NASA Psyche Mission Robotic Explorer

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Multidisciplinary Senior Design

About the Mission to Psyche

- **16-Psyche's Unique Composition:** 16-Psyche is a metal-rich asteroid, primarily composed of nickel and iron, hypothesized to be the exposed core of an ancient planetesimal which offers a unique opportunity to study Earth's core formation.
- **NASA's Goal:** NASA launched an orbiter in 2023 that is scheduled to arrive at Psyche in 2029 to study the asteroid's surface remotely and transmit data back to Earth.
- **Potential Future Mission Goals:** NASA may consider a mission to Psyche's surface in the future, requiring innovative solutions for sample collection, landing systems, and mobility.
- **Universities Collaboration:** NASA is collaborating with Arizona State University which collaborates with other universities across the country whose senior design teams create innovative concepts for the rover's critical functions.
- **Our Project:** Our team is specifically designing a robotic explorer capable of efficiently traversing the hypothesized surfaces of the Psyche asteroid.

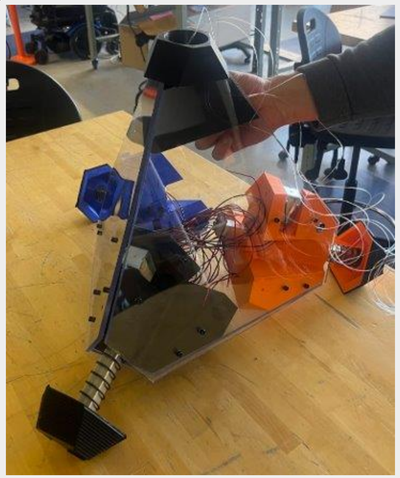
Our Design

- **Unique Design:** the rover has a fully symmetrical pyramidal shape that allows it to move in all directions. : Each corner of the pyramid has a spring on it to allow for movement in any given direction.
- **Hopping Mechanism:** Depending on the compression of each spring, a force is generated in the desired direction of movement. After a command is sent, the rover compress the springs to the needed distance, and then make a hop.
- **Jump Height**: Since the gravity of the asteroid is so low, the amount of force needed to make a rover hop is much smaller than what it would be on earth. Rather than using internal flywheels, we used the hopping mechanism

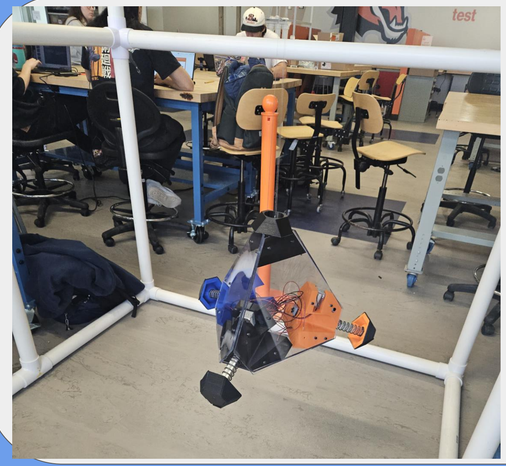
Requirements vs Performance

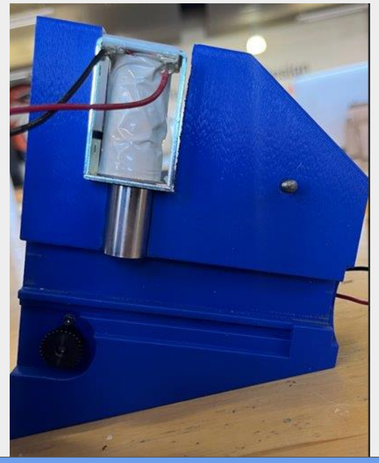
Parameter	Expected Performance	Actual Performance
Battery capacity	130 Watt-Hours	43.42 Watt-Hours
Max velocity	1 meter/min	1.26 meter/min
Jump height	2 meters	2.67 meters (simulated)
Range per mission day	100 meters	126 meters
Total Mass	10 kg	6.35 kg
Dimensions	0.6 x 0.6 x 0.6 meters	0.7 x 0.7 x 0.7 meters
Est. Mission Duration	4 months	3 months

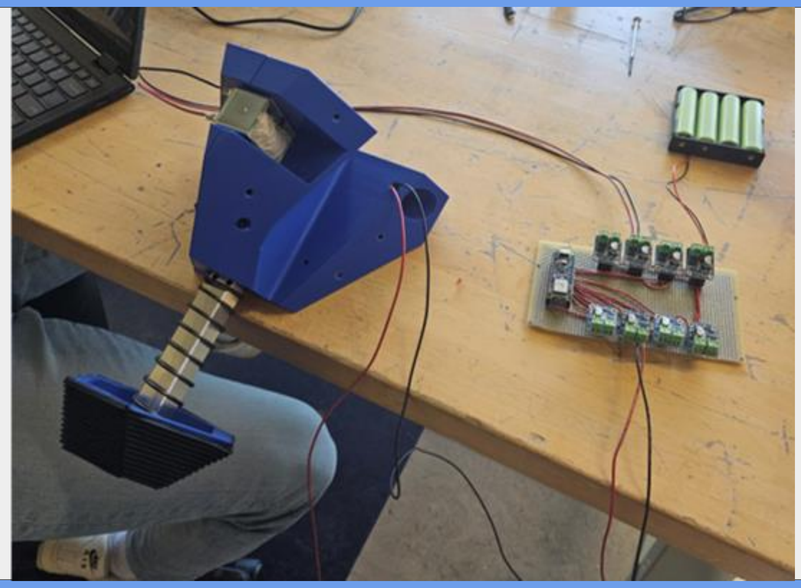
From left to right:
Lanning Torebka, Mechanical Engineering
Zack McGowan, Mechanical Engineering
Luke Webster, Mechanical Engineering
Sean Borkholder, Electrical Engineering
Alec McDougall, Electrical Engineering
Ludovico Zanotti, Industrial Engineering



Design







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Psyche Disclaimer

NASA NEW YORK Space Grant Consortium