

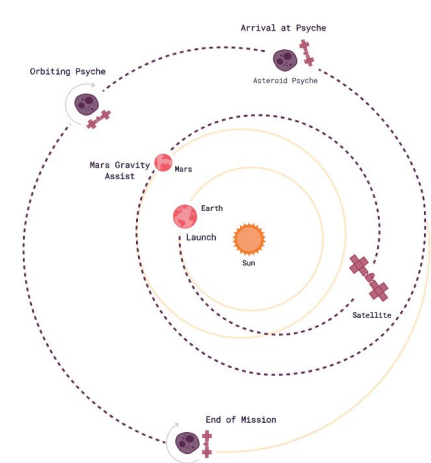
Future Power Solutions for Exploring the Hypothesized Surface of the Psyche Asteroid



Team Members: Hector Bay, Joshua Emmons, William Carlsen, Kayla Hoover, Caleb Blanchard
Mentor: Catherine Bowman

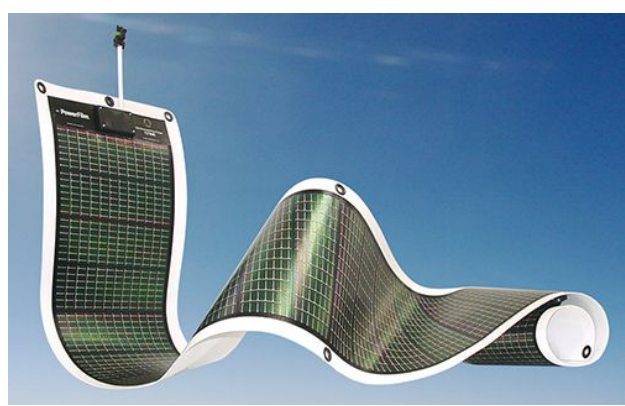
PROBLEM STATEMENT

- NASA plans to research the Psyche asteroid to learn more about its formation and composition in order to relate it to Earth's core formation.
- The Psyche team and ASU are working together to study the surface of the asteroid from orbit.
- A spacecraft was launched on October 13th, 2023 and is anticipated to reach the asteroid in mid-2029.
- Since there is only hypothetical information about the asteroid, a power solution for a far-future rover concept will have to be created by Team 30.



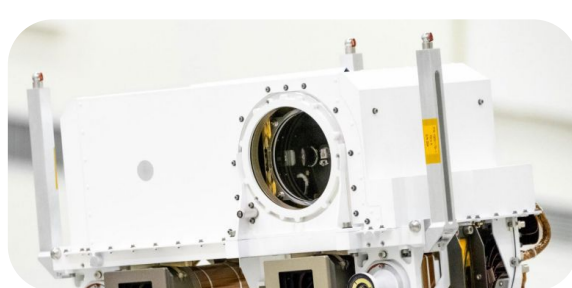
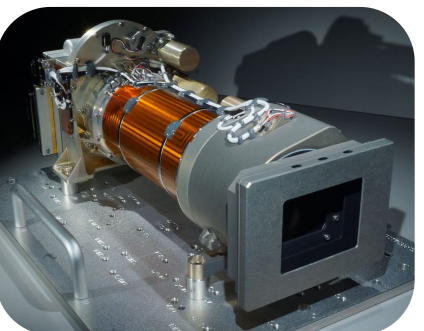
POWER SOLUTION

- Solar Powered Recharging Base Station provides Rover with extended mission capacity
- A Thin Film 3 sq. meter Perovskite Solar Cell provides 50 watts of stored power to power communications and provide charge
- The rover returns to the base station to recharge onboard batteries and resume the mission



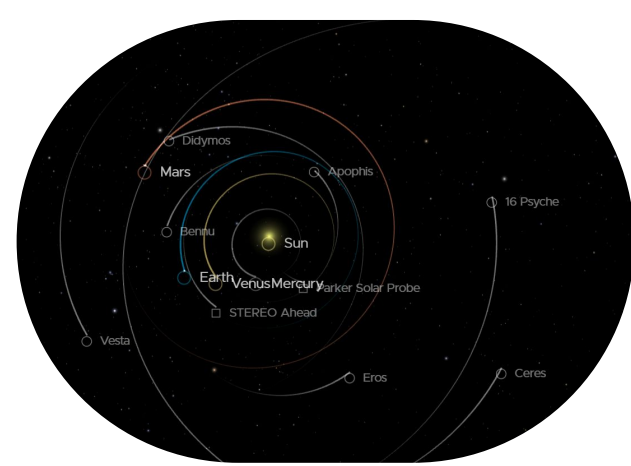
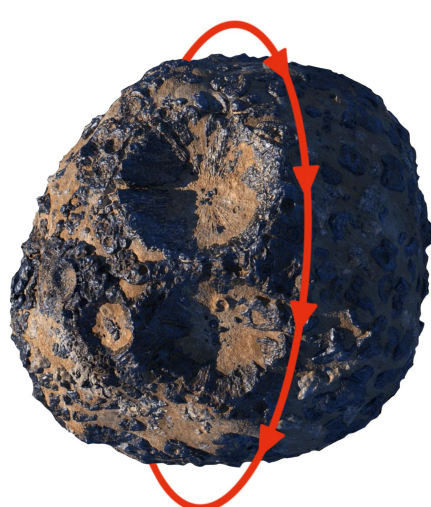
ROVER EQUIPMENT

- Mastcam-Z: Takes HD video, panoramic color, and 3D images of the surface and atmosphere. Also equipped with a zoom lens. (17.4 Watts)
- SuperCam: Identifies chemicals and molecular and atomic makeup of rocks and soils. (17.9 Watts)
- RIMFAX: Used to see geologic features under the surface with ground penetrating radar. (5-10 Watts)
- PIXL: Used to measure the chemical composition of rocks at a very fine scale. (~25 Watts)



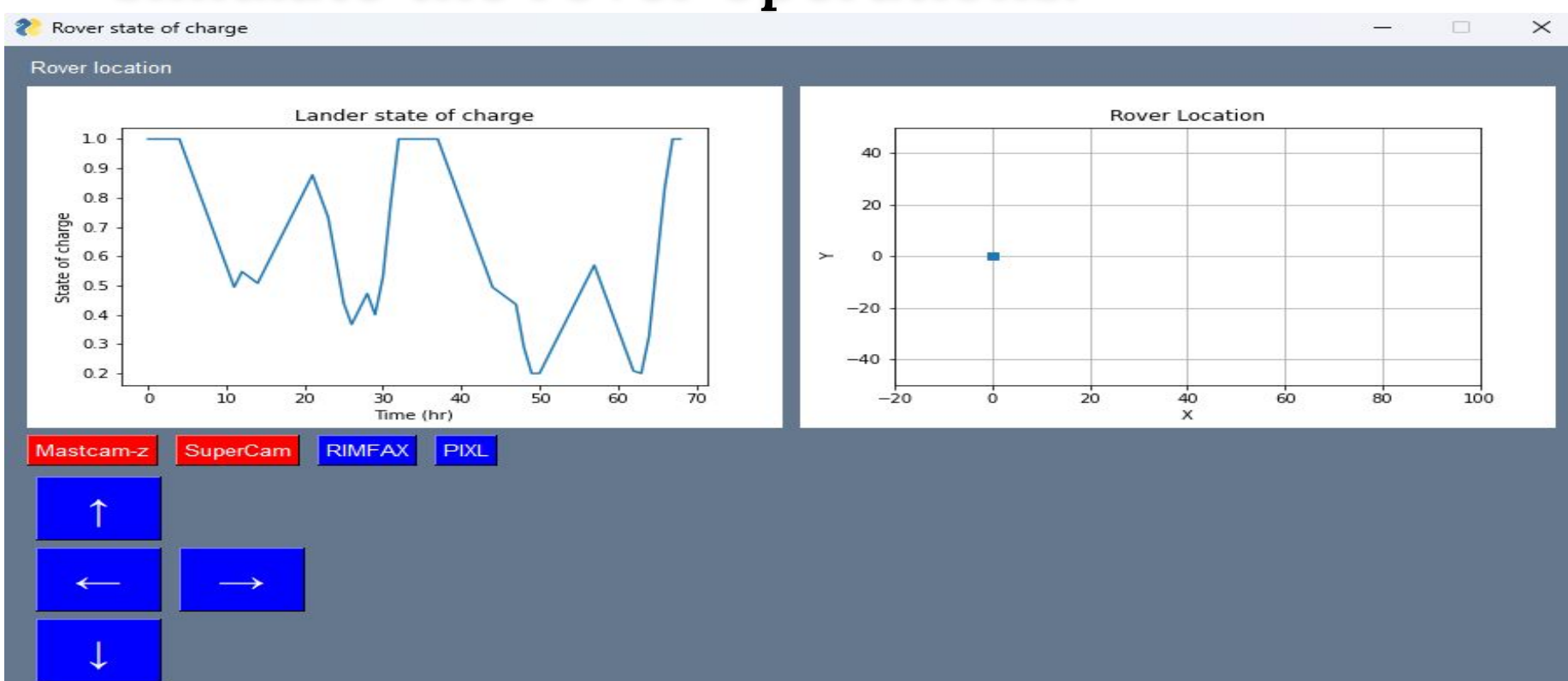
PSYCHE ASTEROID

- Made up of 30-60% metal by volume, unlike most asteroids which are composed of rock and ice.
- Psyche rotates similar to a wheel rather than a top like most space formations.
- It takes 4.2 hours to make a complete rotation on its axis and takes ~1830 days to make a complete orbit around the sun.
- Has dimensions of 173 x 144 x 117 miles, with a surface area of about 64,000 mi².
- Orbits about 3 AU from the sun.



SIMULATION

- The power system for the lander and rover have been modeled in Python and a simulation generated that allows the user to move a representation of the rover around a grid and simulate the rover operations.



WORK CITED

- [1] NASA, "Perseverance science instruments - NASA Science," [science.nasa.gov](https://science.nasa.gov/mission/mars-2020-perseverance/science-instruments/), 2020.
- [2] "Asteroid 16 Psyche | Psyche Mission - A Mission to a Metal World," Psyche Mission. <https://psyche.asu.edu/mission/the-asteroid/>

ASU Ira A. Fulton Schools of Engineering
Arizona State University

This work was created in partial fulfillment of Arizona State University Capstone Course "EEE 489". The work is a result of the Psyche Student Collaborations component of NASA's Psyche Mission (<https://psyche.asu.edu>). "Psyche: A Journey to a Metal World" [Contact number NNM16AA09C] is part of the NASA Discovery Program mission to solar system targets. Trade names and trademarks of ASU and NASA are used in this work for identification only. Their usage does not constitute an official endorsement, either expressed or implied, by Arizona State University or National Aeronautics and Space Administration. The content is solely the responsibility of the authors and does not necessarily represent the official views of ASU or NASA.