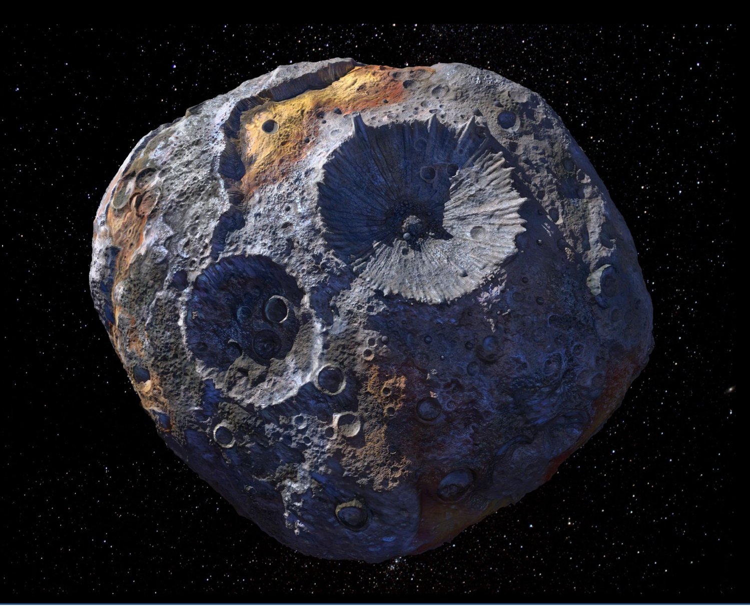


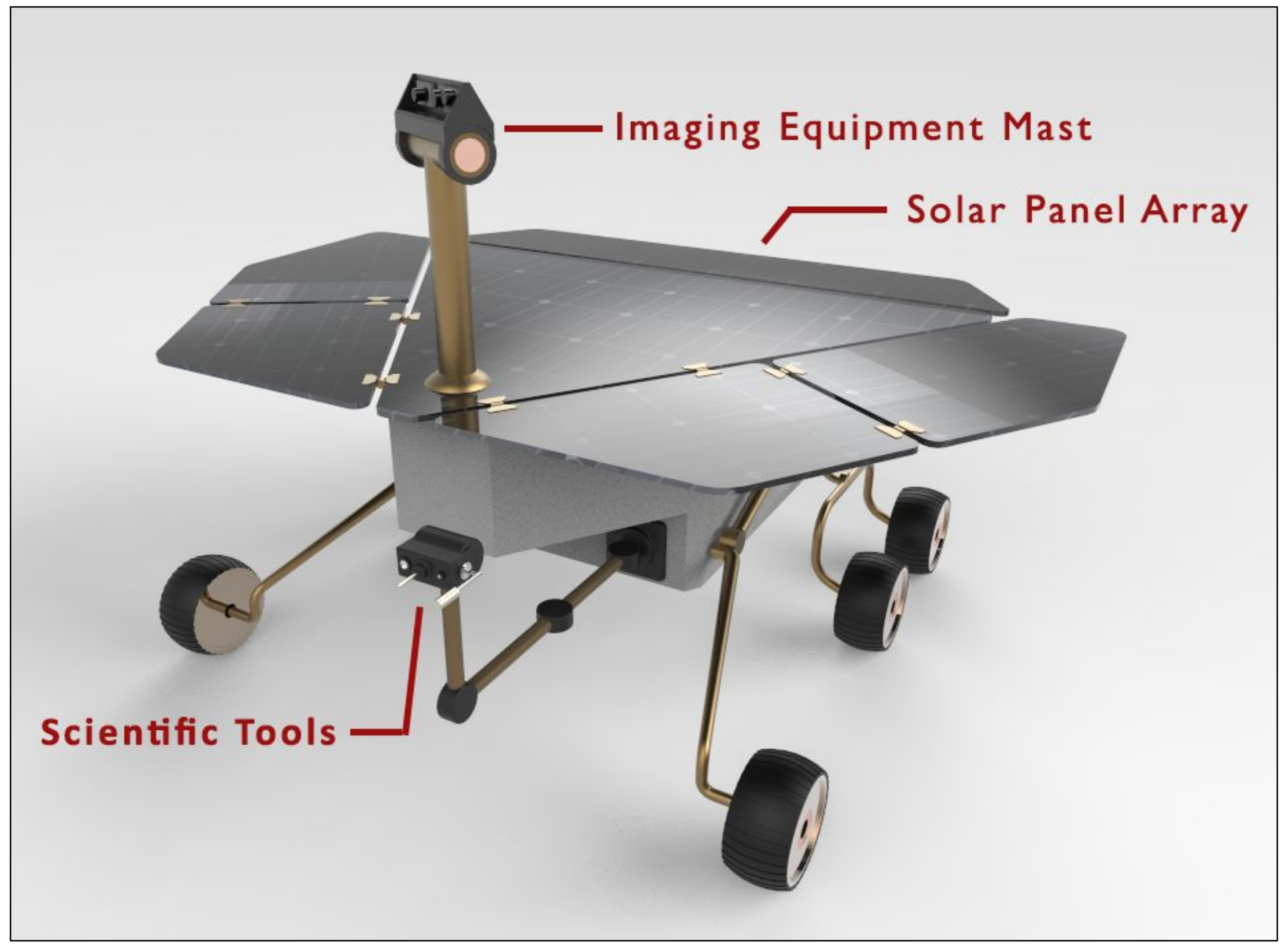
Psyche Rover Future Power System

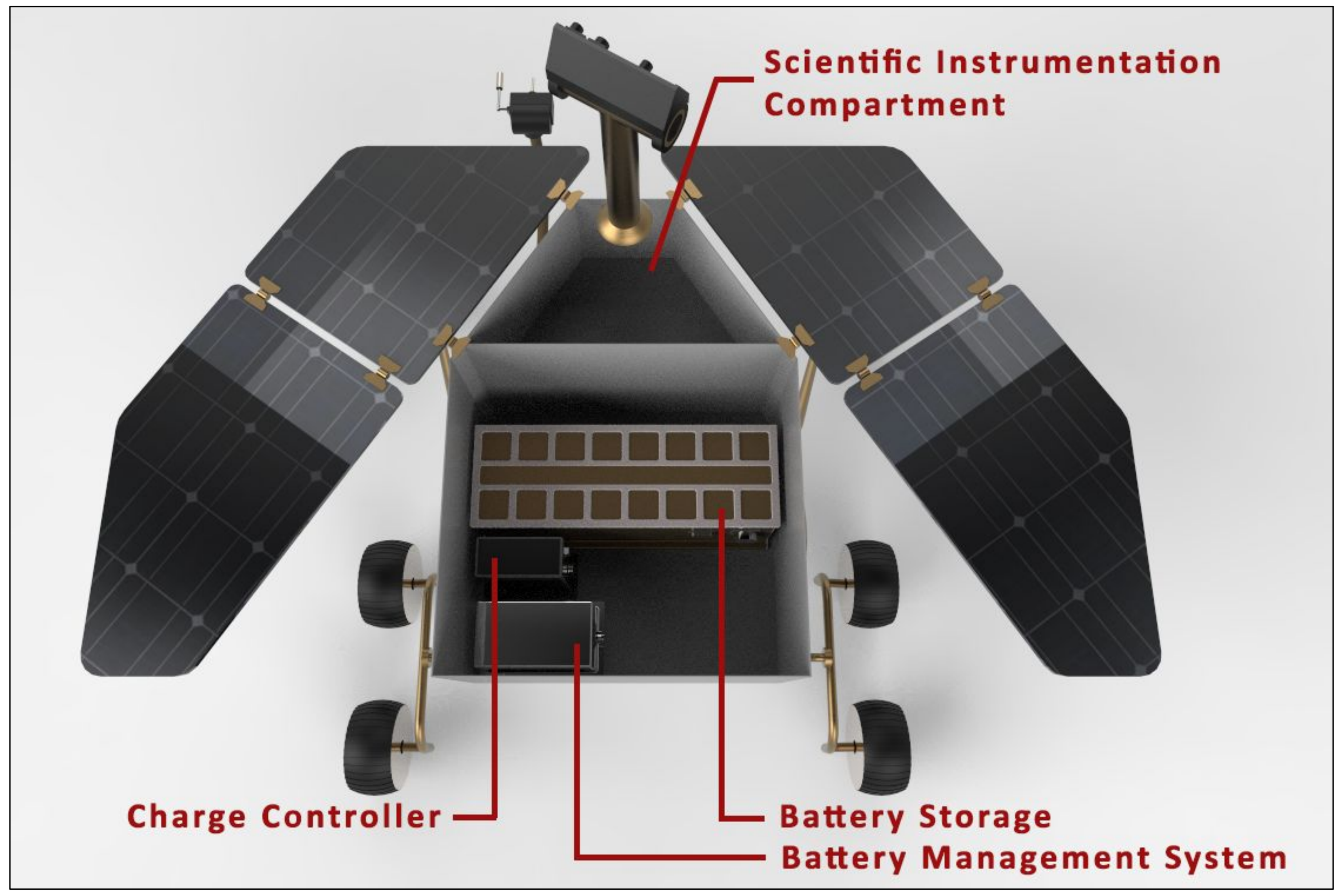
Spring 2025 E.E. Capstone Showcase

Team 18: Brian Sheldon, Johnny Barlag, Matthew Davis, Ryan Petrutsas, Zach Smith

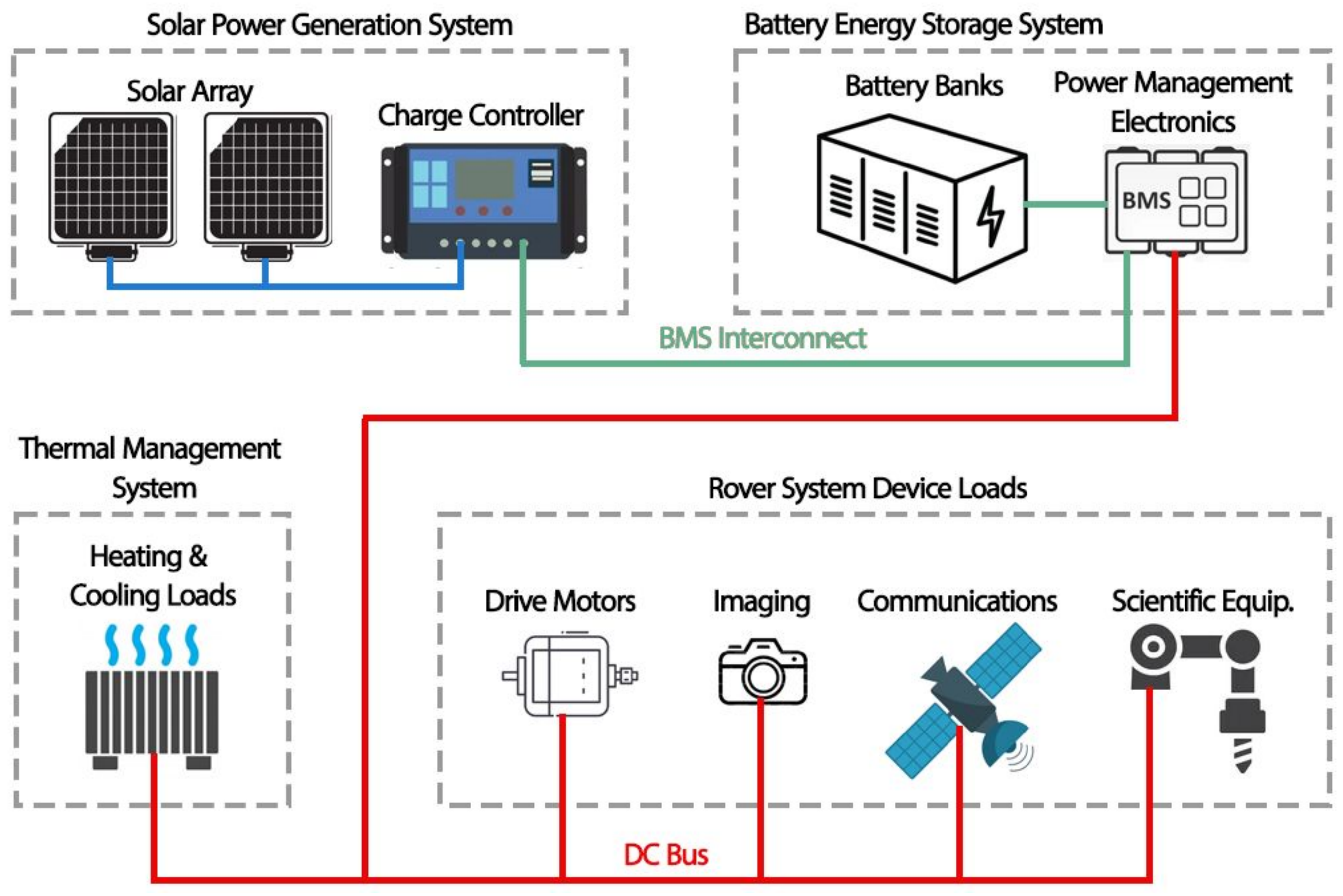
The Mission

Our mission involved the development and design engineering of a modular power system for a hypothetical future rover mission to the surface of Psyche. This power system is a battery electric power system consisting of photovoltaic solar arrays, a charge controller, an energy storage system with lithium ion batteries, and battery management system (BMS) to maintain and manage the onboard power system. Once the landing craft reaches the surface of Psyche its rover will be deployed and operated for short duration scientific missions and can be slowly charged over time to extend the duration of its intended mission as well as provide operational redundancy.





System Architecture



Major Subsystems

- **Battery**
  - EaglePicher SAR-10197: 33.3 V (nominal), 200 Ah, 63.5 kg
- **Power Generation**
  - Solaero by Rocket Lab ZTJ Solar Cells
  - Roughly 2.5 m^2 required at 84 mg/cm^2 and a projected 45% efficiency
- **Rover Component Power Requirements**
  - Drive Motors: Less than 200 watts
  - Spectrometers: Between 5 and 30 watts (operating)
  - Cameras: Between 10 and 20 watts
  - Communications: Between 10 and 40 watts

Performance & Results

- Mission load profile simulated using Python
- Avg. load: ~366 W, Peak load: 591 W during roving phase
- SAR-10197 battery supports multiple complete mission cycles
- Transit SoC strategy: 40–60% (early), 20–100% (pre-deployment)
- Solar input modeled at 69.24 W with 50% usable exposure
- System meets all power demands for a full 58-hour mission
- Simulation confirms system performs reliably under low sunlight conditions

This work was created in partial fulfillment of Arizona State University Capstone Course "EEE489". 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" [Contract 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.

ASU Ira A. Fulton Schools of Engineering
Arizona State University