Deployment of Cable on Hypothetical Surfaces

ENGINEERING

OrbitWorks consists of:
Anas Saleh, Brian Guidry, Jesus Fernandez

Mentor:
Dr. Cassie Bowman

Faculty Advisor:
Dr. Cagatay Tokgoz

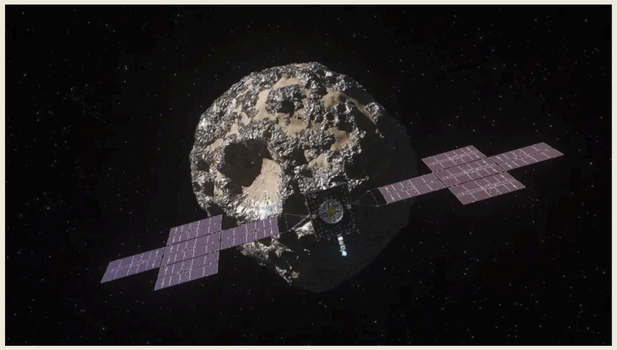
01. Introduction

a. NASA's Psyche Mission

In 2023, NASA launched a mission to explore a unique metal-rich asteroid also named Psyche. The potential high metal composition may mean that Psyche is a partial core of an early planet. This offers an unprecedented opportunity to analyze and explore a planet's core.

b. OrbitWorks' Mission

Our mission is to design a rover capable of not only transversing the hypothetical surface of Psyche, but also deploying 1km of cable on the surface. As electrical engineering students, we will be focusing on the sensors, controls, and power systems of the rover as well as the mechanized deployment of the cable.



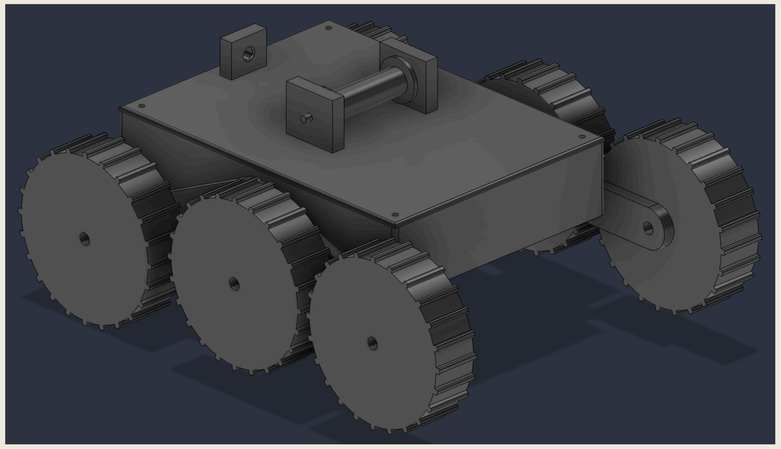
02. Project Objectives

The objective of this project is to design and develop a rover capable of deploying electrical cables across the hypothesized surface of asteroid Psyche. The project aims to demonstrate a functional prototype that can operate under challenging surface conditions and support reliable cable deployment:

- Design a rover capable of navigating uneven and unpredictable terrain.
- Develop an automated cable deployment system with controlled tension and spool operation.
- Integrate sensors and cameras for obstacle detection, navigation, and temperature monitoring.
- Design an efficient power distribution system to support the rover's electrical and mechanical components.
- Build and test a functional prototype to demonstrate the proposed design.

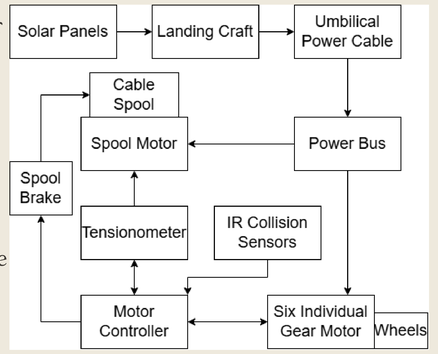
03. Mechanical

We went with a six-wheel rocker bogie suspension system. This layout is essential because it passivly adapts to uneven ground, keeping the main chassis, electronics, and the top mounted spool stable as it traverses the rough, unpredictable terrian of Psyche. We also engineered the chassis with custom wheel geomery for traction, plus a removable top cover with intergrated screw mounts to securely house our internal compoenents and support the spool deployment mechanism.



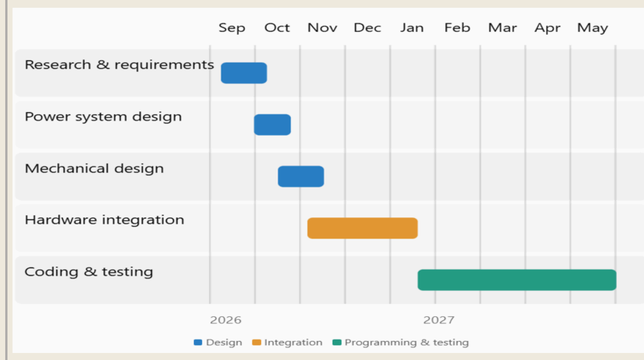
04. Electrical System

- Power will be supplied by solar panels fixed to the landing craft and transfer that power to the rover by an umbilical power cable.
- Microcontroller will be used to manage power distribution, sensors, and actuators.
- In practice a radioisotope thermoelectric generator or radioisotope heater unit will be used to keep systems in an enclosed environment in a safe and effective operating temperature.
- Spool motor will deploy cable to keep a near consistent tension on the cable.
- Buck converters will be used to split incoming power to different voltages needed for the motors and the controlers. Buck converters are much more efficient than linear regulators.



05. Project Timeline

Task	Description	Target Date
Task 1	Research, system requirements, and component selection	Oct. 7, 2026
Task 2	Power requirements and electrical system design	Oct. 20, 2026
Task 3	Rover chassis and cable deployment mechanism design	Nov. 10, 2026
Task 4	Sensor integration, motor controllers, and Raspberry Pi connections	Jan. 15, 2027
Task 5	Programming, system integration, troubleshooting, and final testing	May 20, 2027



06. Budget

Budget Item	Amount
Rover Mechanical Hardware	$900.00
Motors & Actuators	$300.00
Sensors & Lighting	$51.99
Electrical Equipment	$142.00
TSGC Funding (earning)	$1,200.00
Lamar College of Engineering (earning)	$1,500.00

DISCLAIMER

This work was created in partial fulfillment of Lamar University Capstone Course "ELEN 4306". The work is a result of the Psyche Student Collaborations component of NASA's Psyche Mission (https://psyche.ssl.berkeley.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.