



Team Members: Armand Domguia, Gerardo Meza, Juan Hernandez, Karim Ahmed
Sponsor: Department of Mechanical Engineering, University of Texas at Tyler, Texas Space Grant Consortium (T.S.G.C.)
& NASA Psyche Mission
Advisor: Dr. Ermias Koricho

Abstract / Executive Summary

Team HEC-3 developed a compact rover for a possible future mission to the surface of the Psyche asteroid, designed to maintain stability and traction on uneven terrain. The system minimizes vibration and ensures continuous wheel contact, enabling reliable mobility in low-gravity environments

Concept Statement/Objectives

This project focuses on designing a rover capable of safely and reliably traversing uneven terrain in both Earth and space environments.

The rover will feature controlled mobility systems for stability on rough, sloped, and unpredictable surfaces, along with durable materials to withstand extreme environmental conditions.

Specifications

Specifications	Acceptance Criteria	Unit	Testing Method
Rover mass	30-50	Kg	Scale
Rover Payload	50-100	Kg	Simulation
Stability	Roll: 20-30° Pitch: 30-40°	Degree	Test uneven terrain and Simulation
Clearance	15-30	cm	Measure from ground to Chassis

Overview of Rover Model



Fig 1: Physical Prototype Model

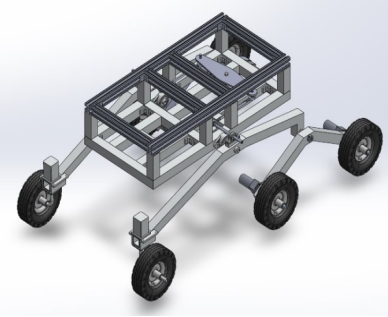


Fig 2: CAD Model



Fig 3: Rover Approach on 20" stone

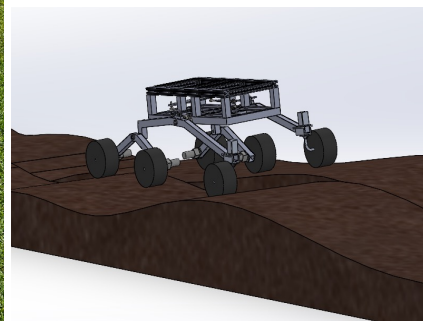


Fig 4: Simulation Over Uneven Terrain

Conclusion

- The rover demonstrates excellent stability and adaptability.
- Structural and stress analyses confirm reliable mechanical performance.
- The Earth based prototype validates mobility and suspension design.
- This work supports future exploration and understanding of Psyche's composition
- The rover-maintained stability within the required 20°-40° range during testing.

Testing / Simulations

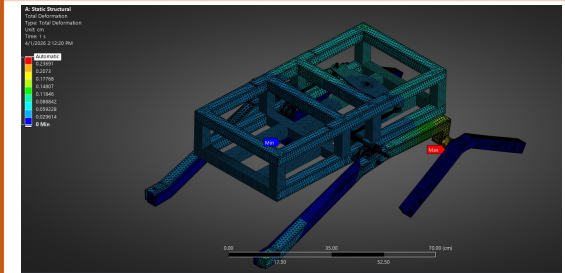
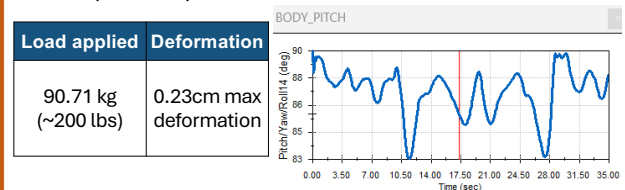


Fig 5: Ansys simulation on bogie shaft

- Performed field testing on brick and curb surfaces to assess real-world conditions.
- Evaluated traction, obstacle climbing, and suspension performance.
- Maintained stable motion with no tipping or structural concerns
- Using Ansys, SolidWorks, Simulations confirmed that the rover's weight distribution, joints, and structural components perform as intended.



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