05F: Landing-UTT: TEAM SPACE EXPLORERS:
Landing System for Hypothesized Surfaces on Asteroid 16 Psyche

Department of Mechanical Engineering, UT – Tyler, Senior Design Project 2026-2027
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Sponsor: ASU, NASA & TSGC, Advisor: Dr. Ermias Koricho

Background

The project develops a landing system for uncertain surfaces on asteroid 16 Psyche. Low gravity and possible uneven terrain make rebound, contact and stability critical. Design conditions: 0.144 m/s² gravity; cold conditions near −200 °C; surface friction and strength not confirmed.

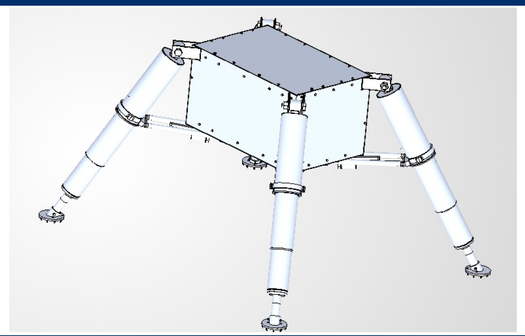
Objective

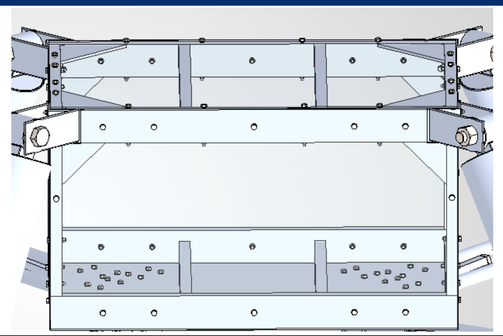
Design a four-legged landing system to absorb touchdown energy, reduce rebound, maintain contact, and allow leveling and anchoring.

Specifications

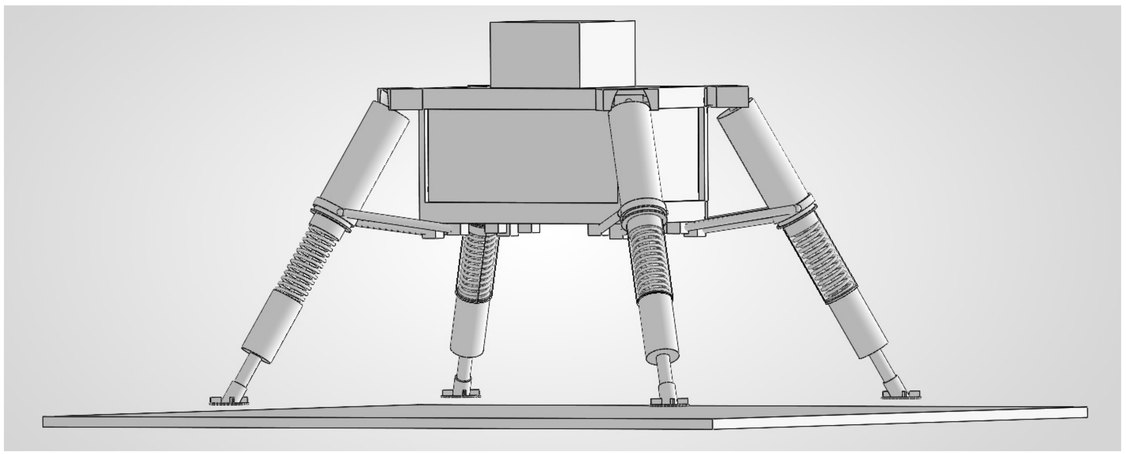
Specification	Value and Units
Mass	≤ 181.437 kg
Touchdown Speed	1.50 m/s
Peak Deceleration	< 15 g
Ground Clearance	> 152.4 mm
Deployment Time	< 60 s
Platform Leveling	Up to 20° slope
Anchor resistance	> 45 lbf per spike

Space Model

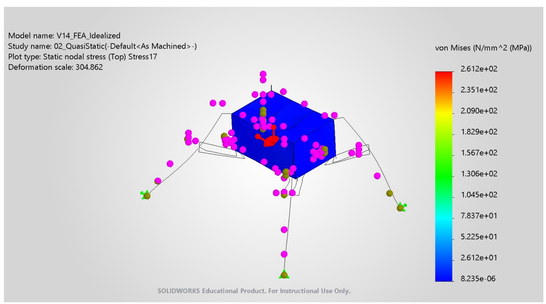


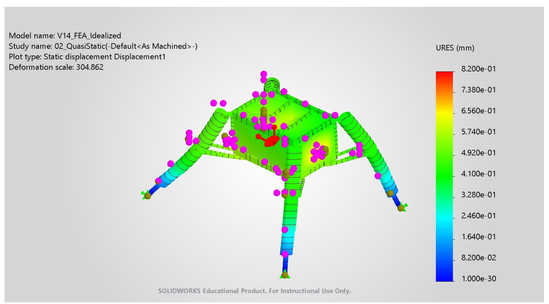


System Motion Study



FEA Stress and Displacement Analysis

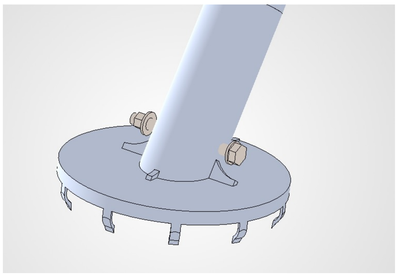


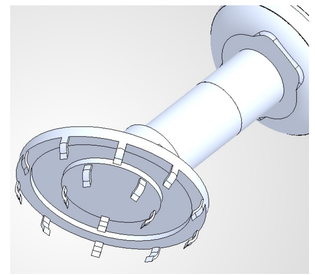


Simulation Summary

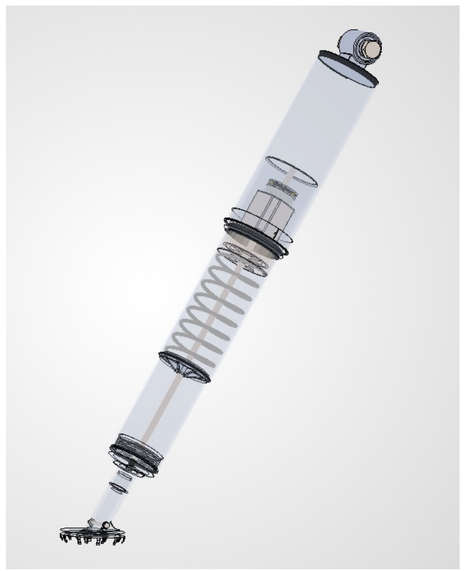
Parameter	Simulation Result
System Mass	164.91 kg
Applied Loads	8 g vertical, 2.5 g lateral
Maximum von Mises Stress	261.2 MPa (junction singularity)
Stress Away from Junction	15.4 MPa
Maximum Displacement	0.82 mm
Allowable Stress	119 MPa

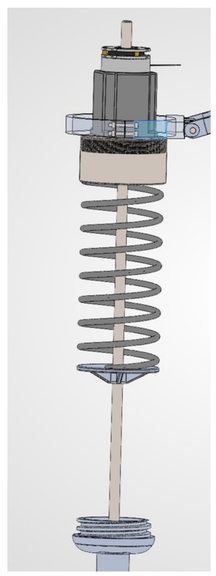
Footpad CAD View





Single-leg CAD View





Mechanism and Energy Analysis

- Selected spring rate: 18,202 N/m per leg.
- Actuator back-driving and braking aim to limit rebound.
- Touchdown kinetic energy at 1.50 m/s

Acknowledgements

Team Space Explorers extends its gratitude to Dr. Koricho for his continued guidance and Dr. Barakat, Dr. Biswas for their invaluable feedback. A very special note of appreciation is reserved for Dr. Bowman and TSGC, whose gracious provision of this project opportunity was invaluable to our team.

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This work was created in partial fulfillment of University of Texas at Tyler Capstone Course MENG 4215. The work is a result of the Psyche Student Collaboration component of NASA's Psyche Mission (psyche.edu) "Psyche: A Journey to a Metal World" {Contract number NNM16AAG9C} is part of the NASA Discovery Program mission to solar system targets. Trade names and trademark 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 official views of ASU or NASA.