ASTROVERSE

TDC-00-SURFACE EXPLORER FOR HYPOTHESIZED SURFACE

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BACKGROUND

- Psyche 6 asteroid features a rocky metallic surface.
- It contains 30%–60% nickel-iron by volume.
- The remaining composition consists mainly of silicate minerals.
- It endures extreme temperatures (60K–250K) and high radiation levels in space.

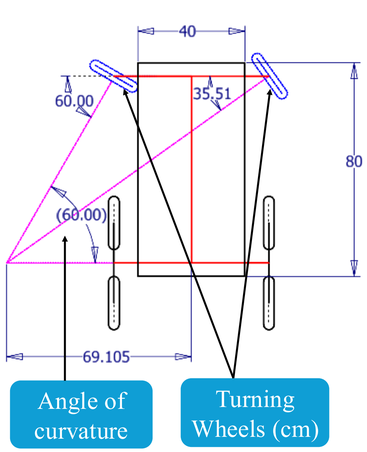
OBJECTIVES

- Design, model, and test a vehicle for the Psyche 6 asteroid
- Ensure performance, durability, and adaptability under extreme conditions

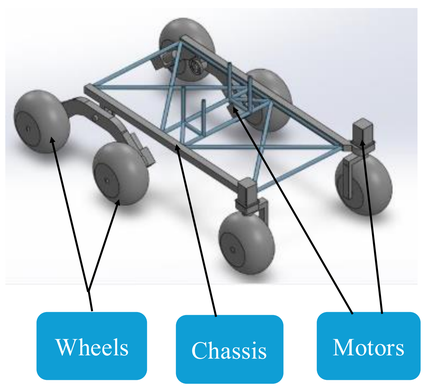
TECHNICAL SPECIFICATIONS

SPECIFICATIONS	DESCRIPTION	DEVICE	UNIT OF MEASUREMENT	METHOD OF TESTING	REQUIRED / OPTIONAL	ACCEPTANCE CRITERA
Rover Mass	Maximum Weight of Rover.	Scale	Kg	Measure with scale	Required	100
Chassis Length	Minimum Length of the Rover	Tape Measure	cm	Measure front to rear of chassis	Required	80-85
Chassis Width	Minimum Length between the Center of Wheel	Tape Measure	cm	Measure distance between outer wheels edges	Required	40-50
Wheelbase Length	Maximum Wheelbase dimensions	Tape Measure	cm	Measure distance between wheel's center	Required	90-100
Suspension / Height	Minimum Clearance of the Rover	Tape Measure	cm	NASA Psyche Hypothesized surface Analog Testing	Required	30-35

SECTION FOR ROVER



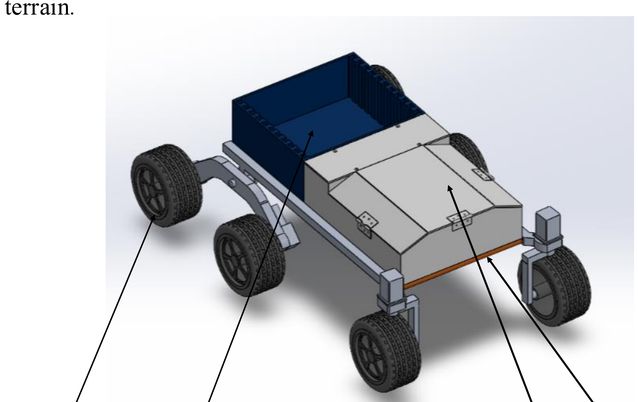
WHEELS TRAJECTORY



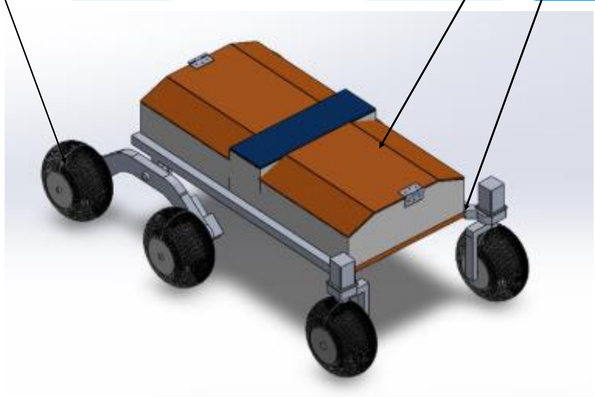
MODULAR CHASSIS

ABSTRACT

- Designed and simulated a rover to explore the metallic and rocky terrain of asteroid (16) Psyche.
- Developed adaptable mobility and suspension systems for stability under low gravity and extreme conditions.
- Conducted CAD modeling and stress analysis to validate structural integrity and performance.
- Plan to assemble and test an Earth-based prototype in Spring 2026 for Psyche-like terrain.

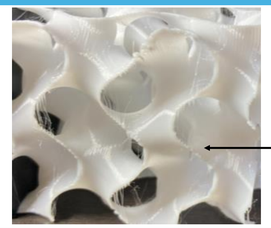


EARTH APPLICATION



SPACE APPLICATION

WALL STRUCTURE



Lightweight, reinforced wall structure designed for strength and durability.

STANDARDS

Construction standards:

- ASME Y14.5
- NASA-STD-10001
- NASA-STD-7002
- NASA-HDBK-7009

Safety standard

- 29 CFR 1926

Environmental standards:

- NASA-STD-8719.27

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.

ACKNOWLEDGEMENTS

- Dr. Ermias Koricho - Advisor
- Dr. Mohammad Biswas - SPB Chair and HEC Coordinator
- Dr. Nael Barakat - Chair of ME Department
- Martinez Nina L. - TSGC
- Dr. Cassie Bowman - Sponsor (NASA)

REFERENCES

- **NASA Standards** – Cited NASA-STD-7002, NASA-HDBK-7009, and NASA-STD-8719.27 for payload testing, modeling, and planetary protection requirements.
- **ASME Y14.5** – Applied for geometric dimensioning and tolerancing in mechanical component design.
- **Material Data** – Aluminum 6061-T6 properties referenced from Mat Web and NASA Technical Report R-377 for thermal and mechanical validation.
- **Reference Rovers** – Design benchmarks from NASA Pathfinder, Perseverance, NAU Rover, CSU Rover, and UT Tyler HEC4 (ROBEX).
- **Manufacturing & Modeling** – Utilized Cura gyroid infill (All3Dp) and NASA BIM standard (NASA-STD-10001) for additive design optimization.
- **Safety Compliance** – Followed OSHA 29 CFR 1926 construction and safety standards for assembly and testing operations.
- **Structural Design Source** – Aluminum tube specifications verified via Amazon Industrial catalog for accurate part dimensioning.