LSU College of Engineering Department of Mechanical & Industrial Engineering
College of Engineering School of Electrical Engineering & Computer Science

To Predict ▶ To Design ▶ To Perform

ME, ECE Capstone Design Programs

Team 24: NASA Human Exploration Rover Challenge

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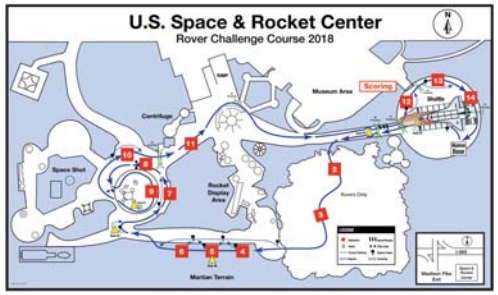
Background

Student competition at NASA in Huntsville, Alabama on April 12-14, 2018.

- Design, build, test, and race human powered rovers on simulated planetary terrain course.
- Win points by completing obstacles and tasks.



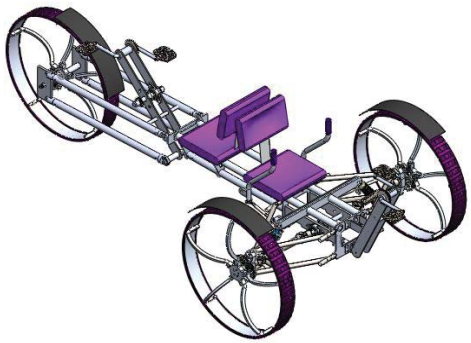
Objective Statement

Design, manufacture, and test a robust human powered vehicle using fundamental and advanced engineering practices to complete the NASA competition mission objectives, in order to gain points and place first.

Engineering Specifications

Specification	Target	Actual
Maximum Speed	≥10 MPH	✓
Turn Radius	≤ 15 ft	✓
Vehicle Weight	< 170 lbs	×
Width	≤ 5 ft.	✓
Fender Area	≥ 120 in^2	✓
Collapsed Dimensions	≤5x5x5 ft^3	✓
Driver Clearance	≥ 15 in. from grade	✓

CAD Model Versus Actual Prototype



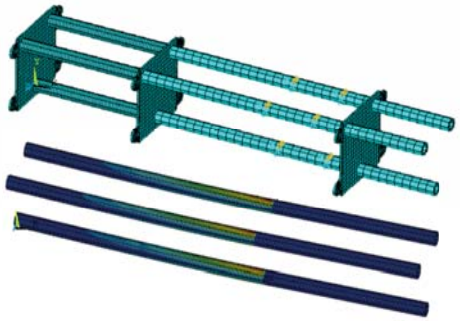
Main Component Analysis

Frame
Loads Applied:

- 1500 lb. impact load
- 375 lb. at upper supports from suspension
- Fixed at seat supports

Results:

- Max Stress: 27.7 ksi seat supports
- Yield Strength of 6061-T6 Aluminum: 40 ksi
- Factor of Safety: 1.44

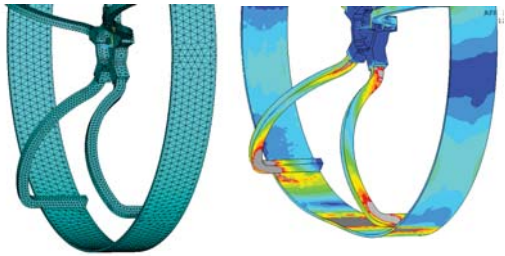


Wheel
Loads Applied:

- 1500 lb. impact between spokes

Results:

- Since tetrahedrals are unreliable, results were only used qualitatively
- Max Stress: above yield at curve of supports
- Increased the thickness of the spokes at this location

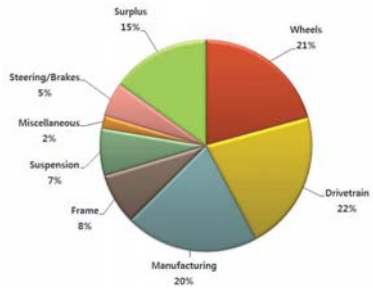


Testing Plans

Vehicle Turn Radius – Rover must be able to turn within the constraint in order to progress through the course
Vehicle Stability – Steep inclines/rough terrain require rover to be stable with a well-positioned center of mass
Vehicle Speed – Find the top vehicle speed and time to get there to accurately predict course time
Proficiency – Rover needs to allow drivers to complete tasks, as well as obstacles
Dye Penetrant/Fillet Weld Bend Test – Examine weld fusion and porosity of welded Aluminum

Budget

$7500 Total Budget



Manufacturing

Water jet - Frame bracing, crankset supports, wheel spokes
CNC mill – Wheel hubs, connecting yokes, etc.
CNC lathe – Suspension and frame connections
Wire EDM – Control arm connectors
Manual lathe – Shafts, collars, rear frame connectors
End mill – Rear wheel hubs, various frame components, boring/drilling
TIG and MIG welding – Aluminum and carbon steel

Concept Generation Sep 19 – Oct 2 → Concept Selection Oct 3 – Oct 18 → Engineering Analysis Oct 19 – Nov 30 → Purchasing Dec 1 – Mar 31 → Manufacturing/Assembly Dec 15 – Apr 1 → Testing Apr 1 – Apr 11 → Competition April 12-14, 2018

Adviser: Dr. Glenn Sinclair