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Team 24: NASA Human Exploration Rover Challenge

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Objective Statement

The objective is to successfully compete and place 1st in the 2019 NASA Rover Challenge by designing, manufacturing, and testing a robust all-terrain, human powered vehicle using fundamental engineering practices.

Engineering Specifications

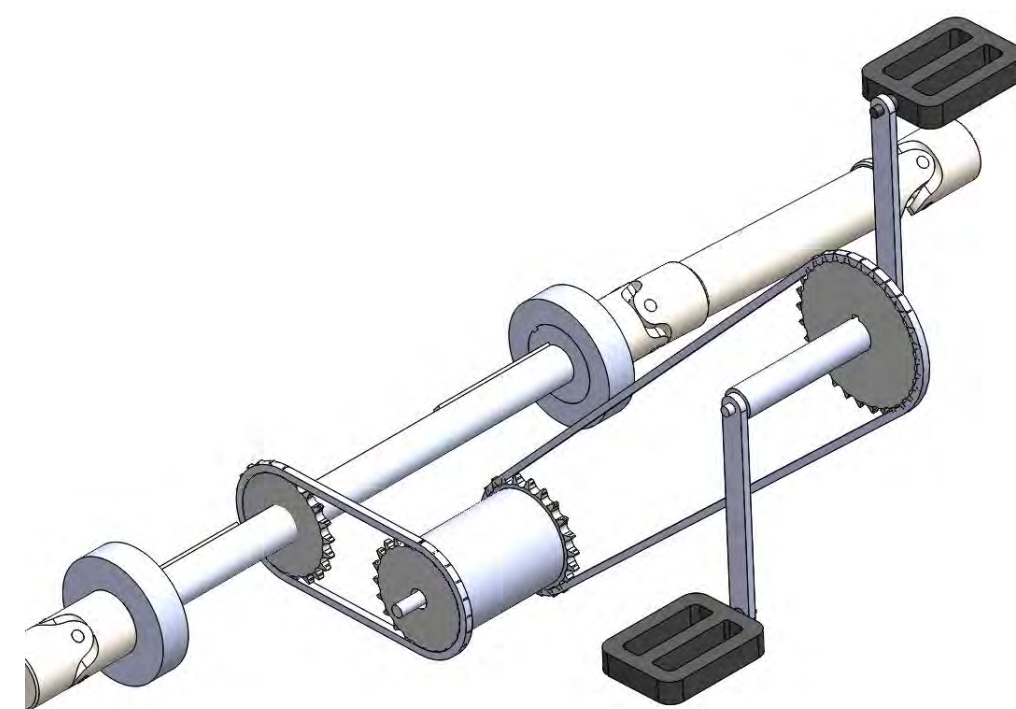
Team-Imposed		
Course Time	≤ 7 min	5:46
Maximum Traversable Incline	≈ 30°	✓
Rover Weight	≤ 210 lbs	182 lbs
Assembly Time	≤ 2 min	1:08 min
Max Rover Speed	≥ 10 mph	12 mph

Competition-Imposed		
Rover Width	≤ 5 ft	4 ft 8 in
Turning Radius	≤ 15 ft	14 ft
Driver Clearance	≥ 15 in	20 in
Collapsed Volume	≤ 5 ft x 5 ft x 5 ft	✓

2019 LSU Rover

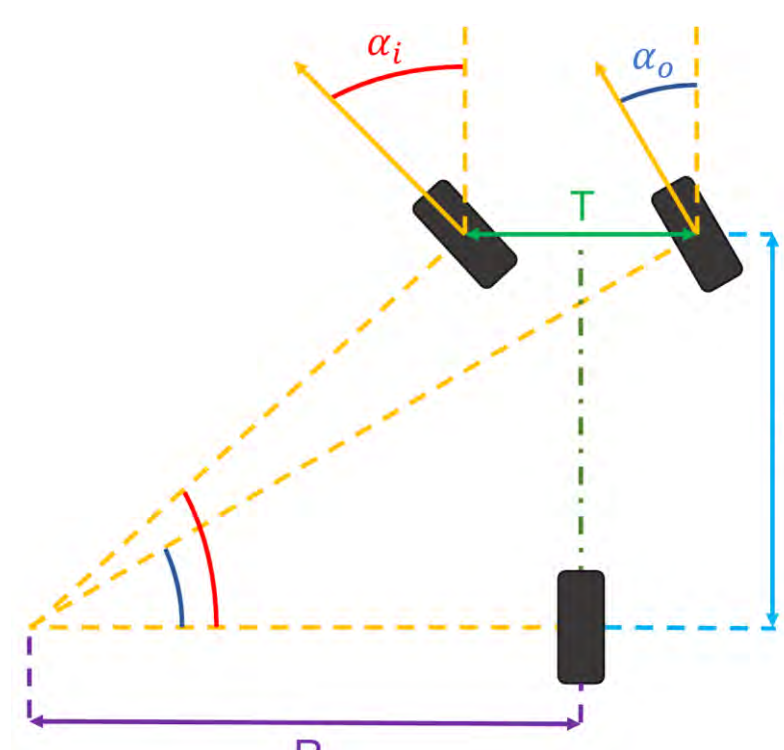


Drivetrain & Steering Subsystems



$$GR_{high} = \frac{\omega_{in}}{\omega_{out}} ; GR_{low} = \frac{T_{out}}{T_{in}}$$

Front Driver Gear Range: 0.79 – 1.56
Rear Driver Gear Range: 0.64 – 3.16

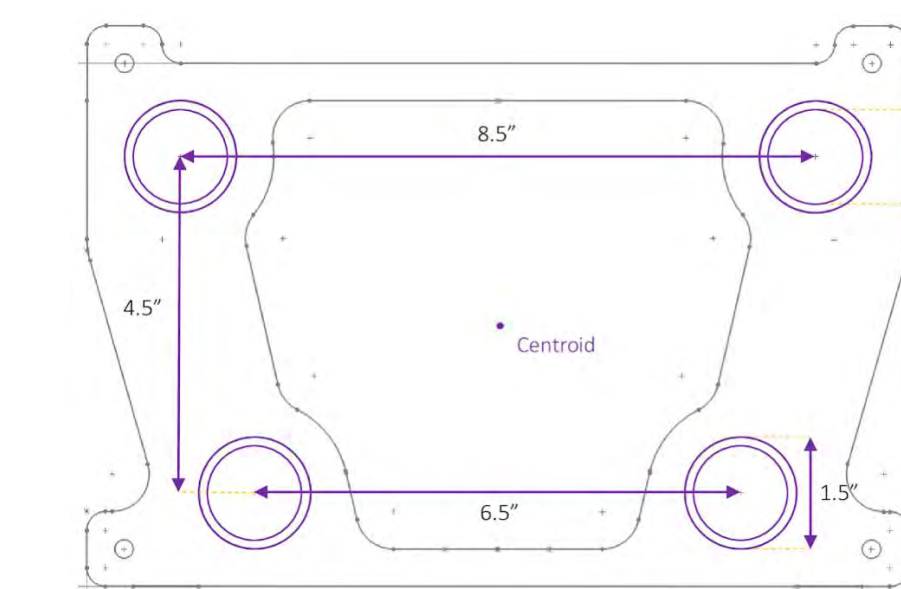
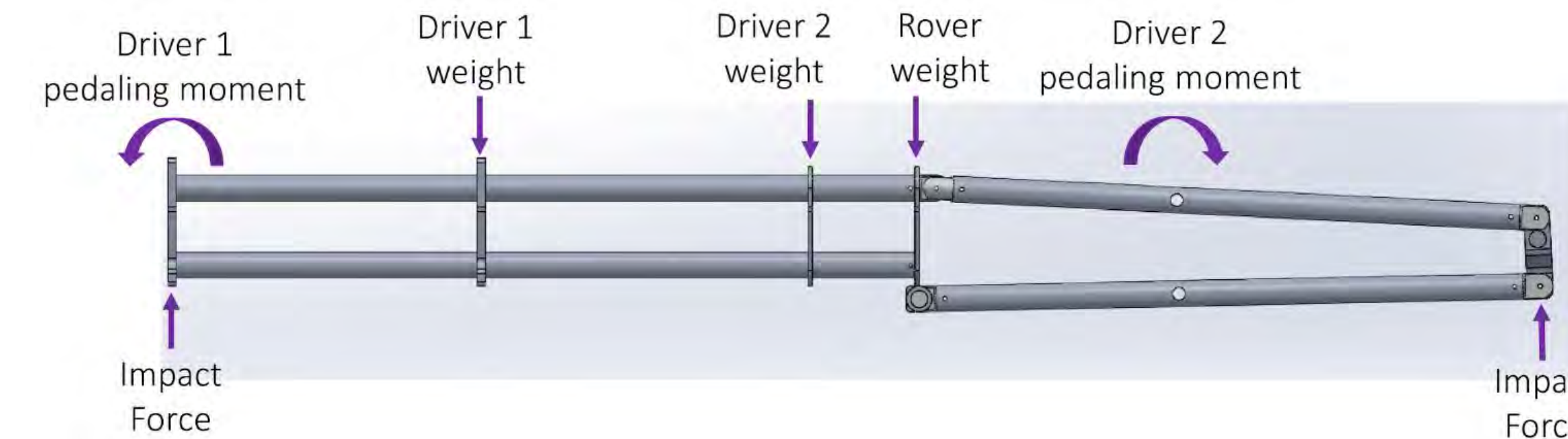


$$\alpha_i = \tan^{-1} \left(\frac{L}{R - \frac{T}{2}} \right)$$

$$\alpha_o = \tan^{-1} \left(\frac{L}{R + \frac{T}{2}} \right)$$

Required turning radius: 15 ft.
Actual turning radius: 14 ft.

Frame & Wheel Subsystems



Objective: Large area moment of inertia to resist bending from impact forces.

Max. Bending Moment = 5,602.5 lbf-ft
Required Moment of Inertia = 3.7817 in⁴
Actual Moment of Inertia = 42.3613 in⁴



Wheel weight 2018: 19 lbs
Wheel weight 2019: 11.5 lbs

Weight reduction:
 $100\% * \frac{19 \text{ lbs} - 12 \text{ lbs}}{19 \text{ lbs}} = 36.8\%$

Safety

- Seat belts
- Safety glasses
- Long sleeve shirts
- Dulled edges
- Long pants
- Bicycle helmets

Manufacturing

Frame – Bandsaw, waterjet, manual lathe & mill, aluminum welding
Wheels – Carbon fiber hand layup, manual lathe & mill, rubber tread molding, CNC lathe & mill
Suspension – Bandsaw, manual mill, steel welding
Drivetrain – Manual lathe, CNC lathe, CNC mill, aluminum welding
Steering – Manual lathe & mill

