Design and Development of a Human Powered Vehicle: NASA Competition

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Donors: Great Bicycle Shop, University Cycles

Sponsor: Florida Space Grant Consortium

TEAM 17

The Competition Basics

Prototype a vehicle that …

- Is human-powered
- Accommodates two people
- Has off-road capabilities
- Is ‘small’ and ‘light’
- Is safe
- Wheels must be manufactured

Needs Statement:

“There needs to be a ground vehicle powered by fit male and female drivers that is capable of competing in the NASA Human Exploration Rover challenge.”

Restated Goals Statement:

“Successfully create a working prototype vehicle. Attempt to win the rookie award at competition.”

LAST YEAR'S OBSTACLES

FIGURES 2-5. PURDUE-CALUMET WINNING COMPETITION FOOTAGE[1]

Component Morphology

Design chassis

- Frame style, material, suspension, collapsibility, seat orientation

Design of drivetrain

- Chains, belts, reciprocating lever transmission
- Two-wheel vs. all-wheel drive
- Separate or combined drivetrains for two drivers

Steering

- Steering wheel, hand levers
- Two-wheel or all-wheel steering

Brakes

- Disc brakes, drum brakes, rim brakes

Design of wheels

- Materials, size, shape, tread

Rhode Island School of Design

- 2nd place at the 2016 competition
- Excellent online documentation
- Approval from RISD team to use their online webpage(s) as resources for our design

Figure 6: RISD Rover 2016

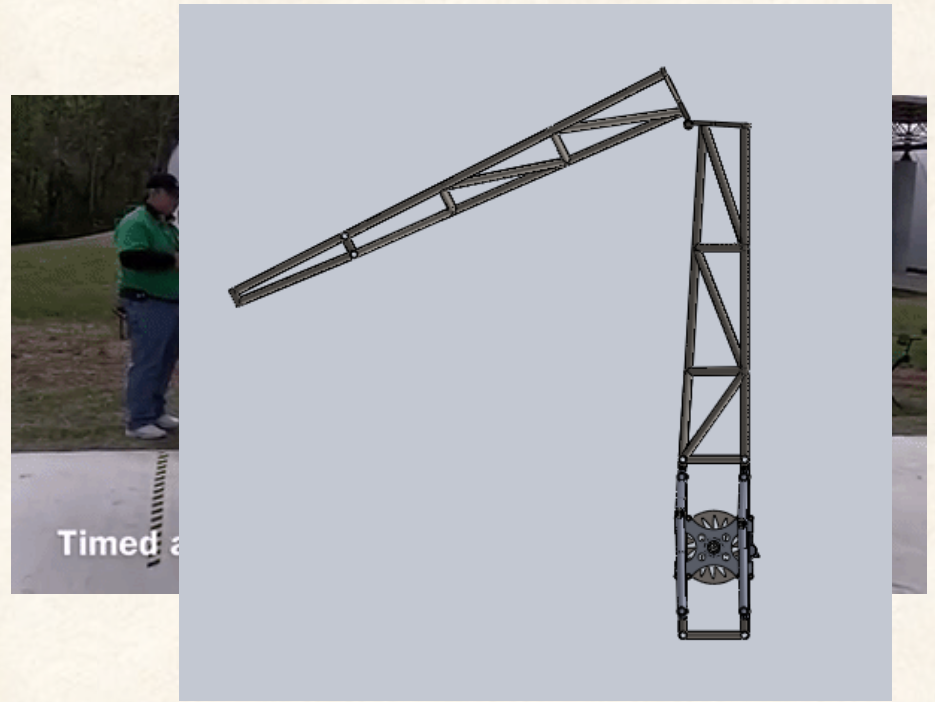
Collapsibility

Constraint: Rover must fit within a 5 x 5 x 5 cube

Solution: Folding Chassis Joint allows rover to fold

- 2 – 1/4 in. triangular plates
- Hinges welded to bottom
- Material: water jet cut A36 steel
- Welded onto the midsection of the chassis

Folding Chassis Joint Assembly



Figures 7-8: Chassis Fold

Current Frame Iteration

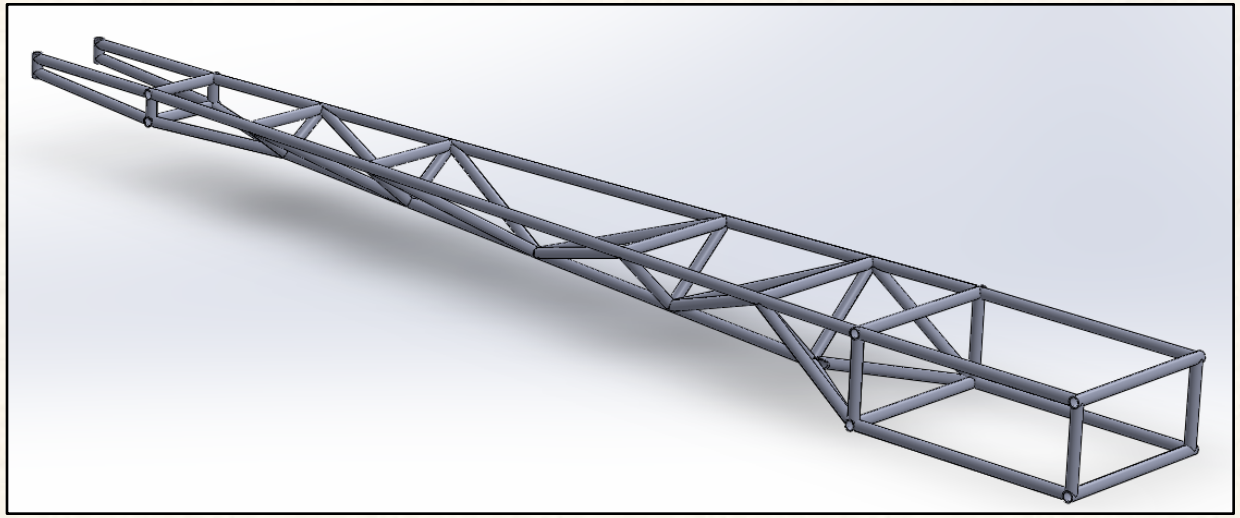
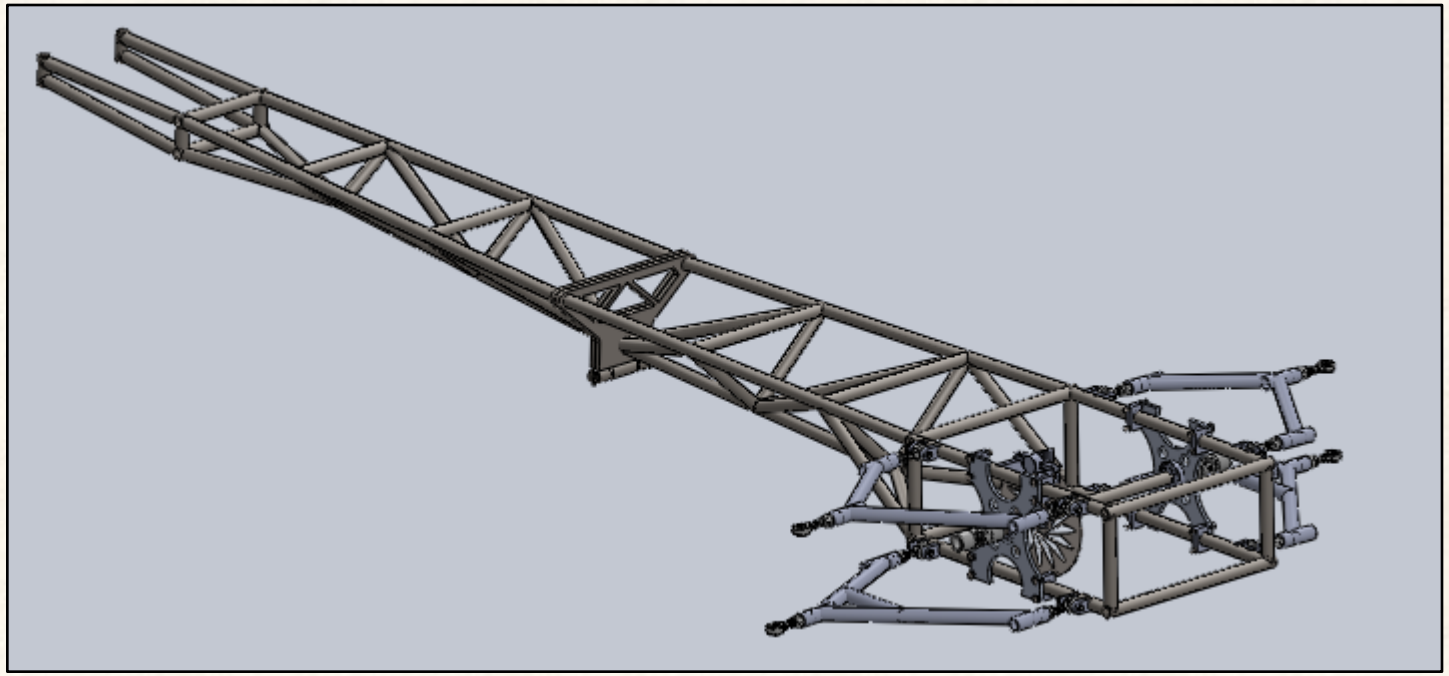


Figure 9-10: Current Frame Iteration and welding

*Frame overall dimensions based off RISD and Seating Calculations

Assembly



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Figures 11-12: Current Assembly

Rear Drive Train

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Possible Modification: Simplify mechanism by having rear rider pedal backwards instead

Figures 13-15: Rear Drivetrain

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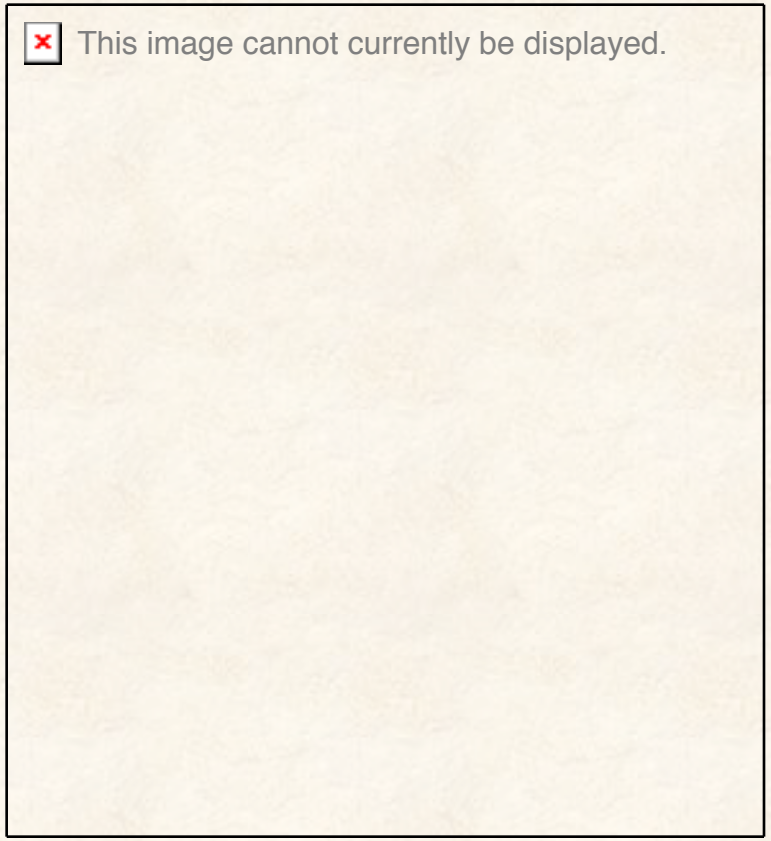
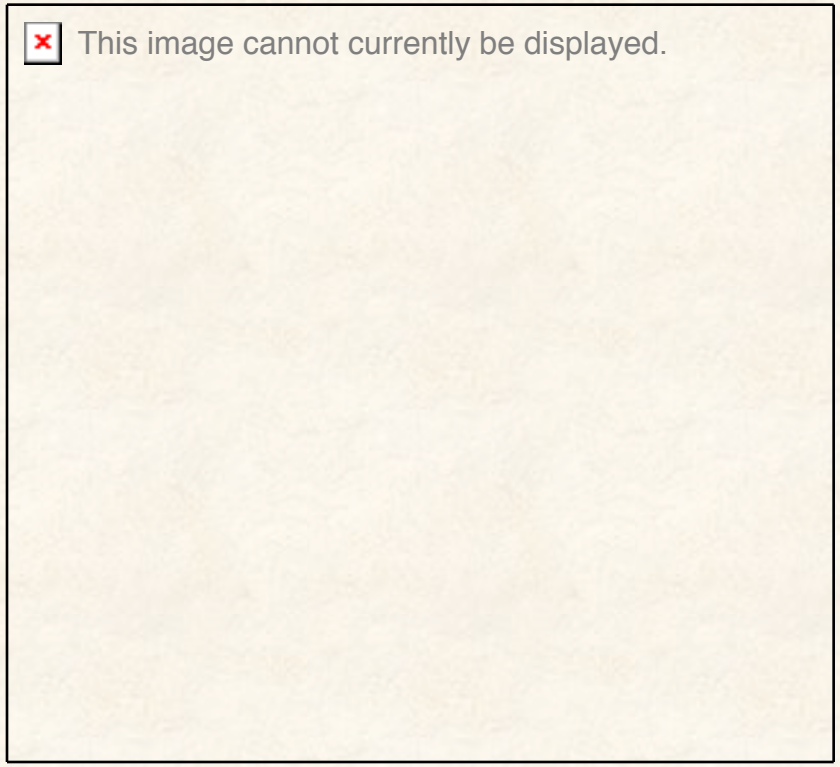
Wheel Design

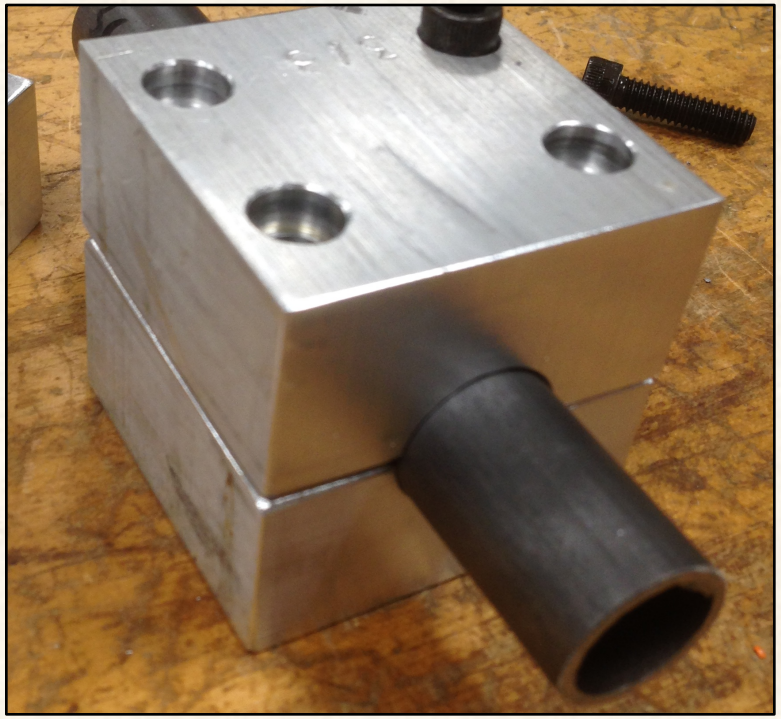




Figures 16-18: Wheel Design

- Tread needs be purchased
- Lug nut holes need to be adjusted for purchased hub

Manufacturing progress



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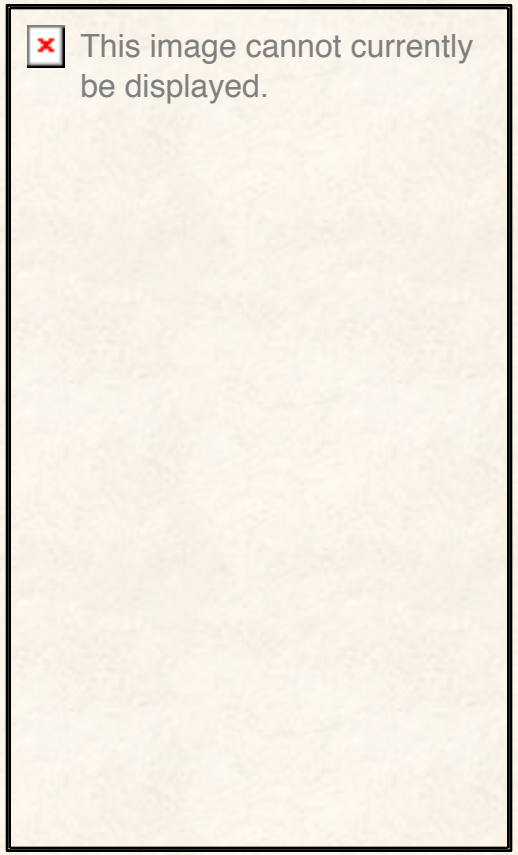
Figures 19-21: Machining Progress

Purchase parts



Figures 22-25: Purchase Parts

To expedite the build process, the following items will be purchased (and design slightly altered to accommodate) among others if feasible:

- Seats
- Freewheel sprockets
- Wheel Hubs

Upcoming and current tasks

Materials on Order

- Wheels
- Front Drivetrain
- Hinge Assembly
- Tab Assemblies

Under design revision for manufacture

- Suspension

Design and Modeling Phase

- Rear Drive Train
- Seating Assembly

Currently manufacturing

- Chassis

Gantt Chart

Acknowledgements

Thank you to these local businesses for bicycle parts:

- University Cycles
- Great Bicycle Shop
- Joe's Bike Shop

Thank you to the student machine shop for information on designing for manufacturing.

Thank you to SAE for advice on vehicular design.

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References

http://portfolios.risd.edu/gallery/23181693/RISD-DTC-Moon-Buggy-Parts

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