Human Powered Vehicle Team

Virtual Design Review 4

Team 20

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The Team

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Team Lead

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Financial Manager

Miguel Rodriguez
Scribe

Updated Project Scope

- This semester, our team will be responsible for:
  - Assembling our prototype
  - Testing its speed, handling and braking characteristics
  - Provide a lasting legacy for the college of engineering

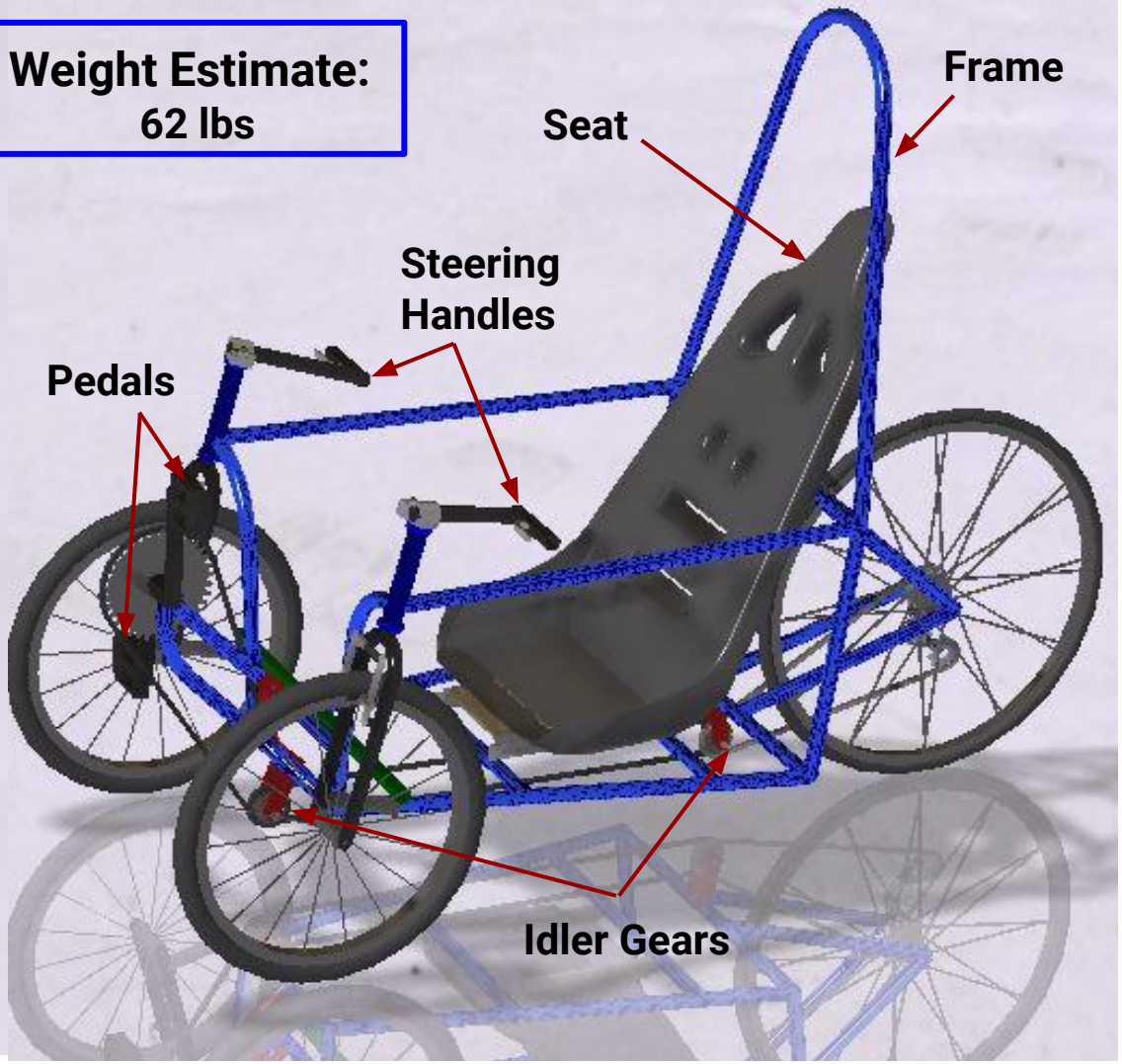
- In other words, our team will create a robust vehicle to serve as the foundation for upcoming engineering students to modify and compete with in future Human Powered Vehicle Challenges.

Current Progress

- Ordering and Purchasing Parts
  - Chromoly tubing from McMaster-Carr
  - Bike components for steering, drivetrain, etc.
  - Recumbent seat from Niagara Cycles
  - 5-point harness
- Establishing future of FAMU-FSU HPVC
  - Generating interest from EDM students, ASME club members, SAE club members, etc.
  - Creating a framework for future club and or recurring senior design project
  - Leaving our legacy here at the FAMU-FSU COE

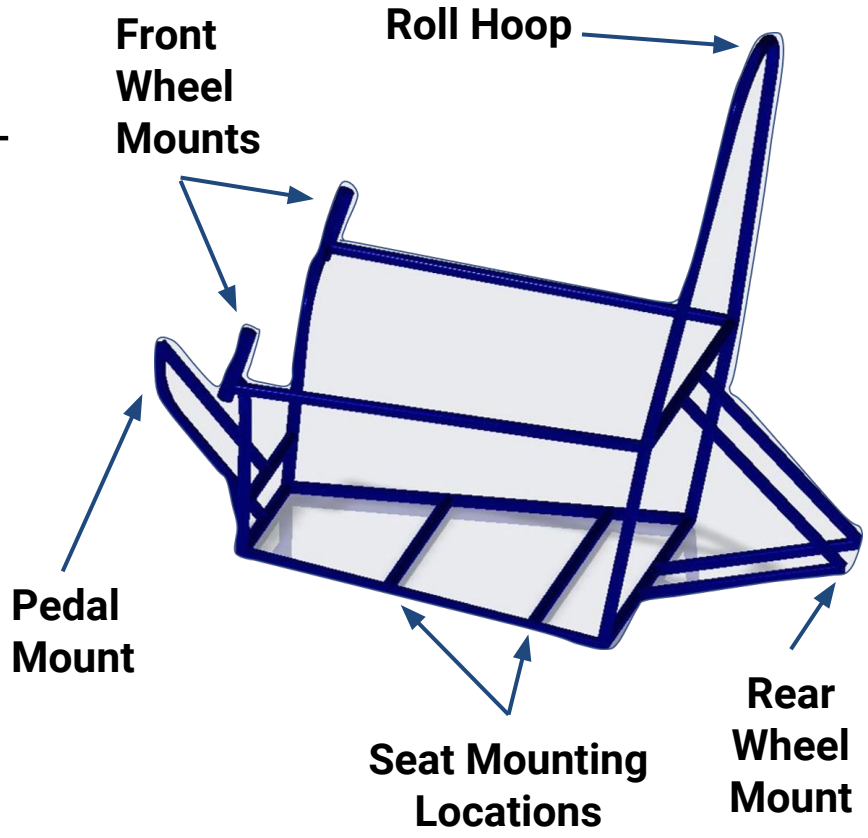
Current Design

- Frame
  - 4130 Steel
  - Yield strength: 70,000 psi
- Drivetrain
  - Interchangeable pedal configuration
  - Rear wheel drive
  - Idler gears underneath frame
- Steering
  - Wheels pivot within frame similar to the front end of bike
  - Both connected with a tie rod
  - Steer in side-to-side motion
- Recumbent Seat
  - Adjustable seat for different riders
  - Positioned for comfort and maximum power output potential



Chromoly Frame

- **Frame Characteristics**
  - Requires:
    - 24’ tube of 1” OD, .083” WT
    - 18’ tube of 1” OD, .049” WT
    - 3’ tube of 1.25” OD, .095” WT
    - *(OD: Outer Diameter)*
    - *(WT: Wall Thickness)*
  - Cost: *$399.25* w/ shipping
  - Weight: 29.1 pounds
  - Vendor: McMaster Carr

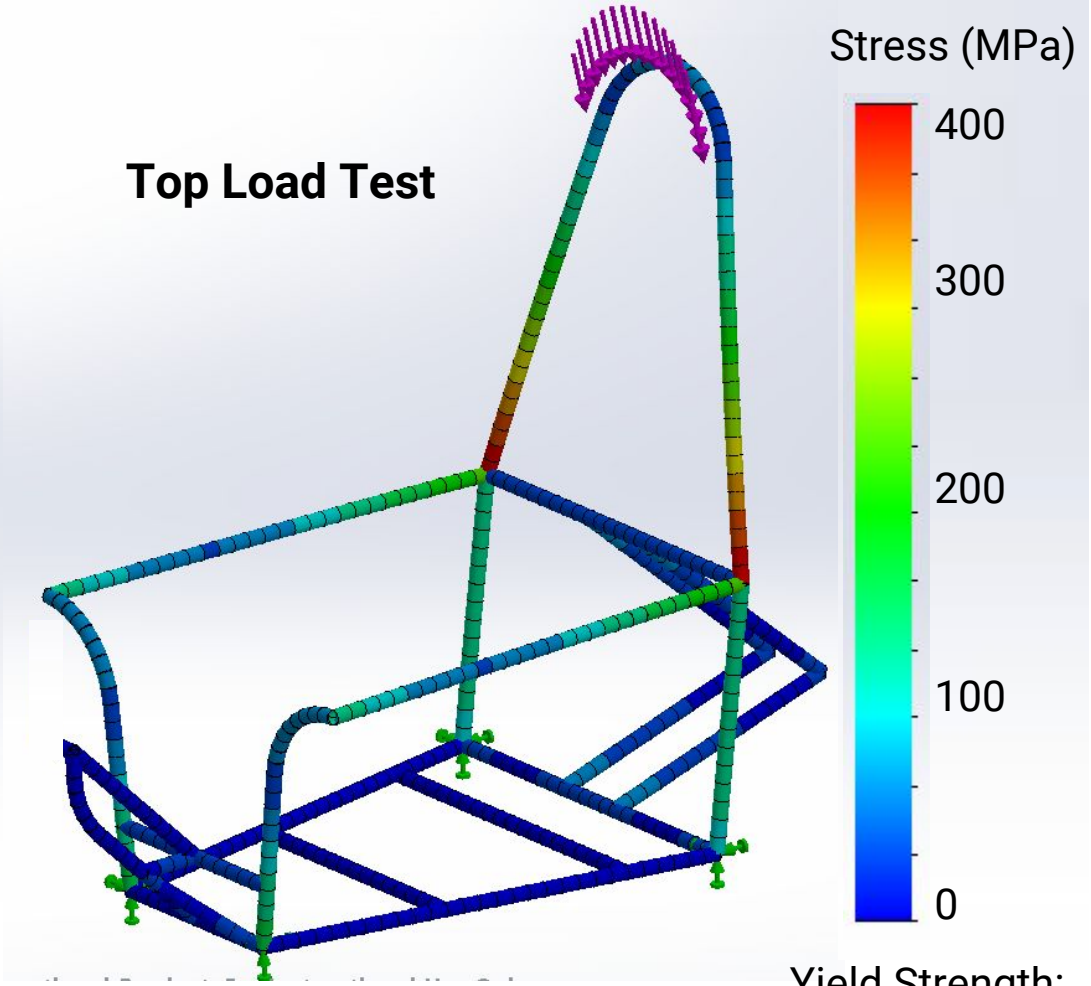


Chromoly Frame (cont.)

Top Load Test:

600 lbf at 12° offset from vertical

- Maximum stress: 396 MPa
- Safety factor: 1.16



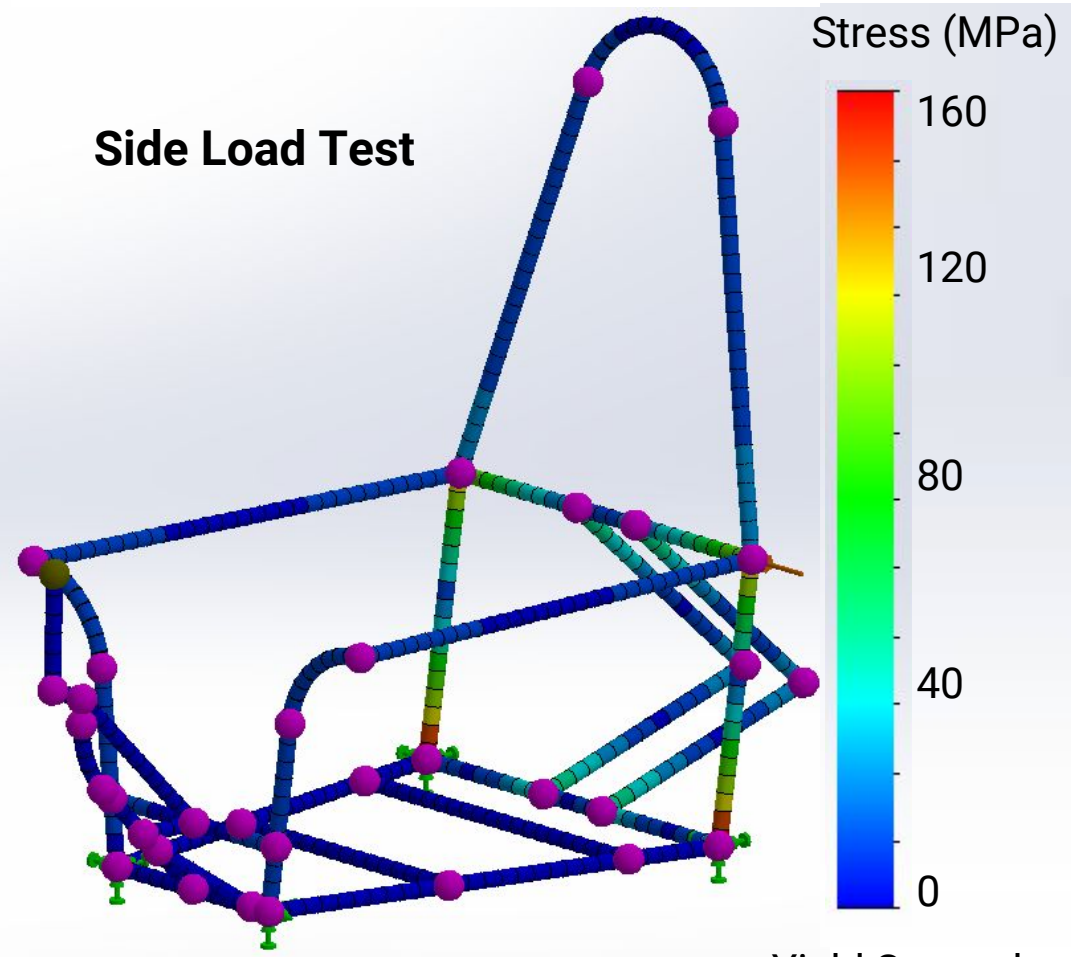
Yield Strength: 460 MPa

Chromoly Frame (cont.)

Side Load Test:

300 lbf applied horizontally at shoulder height

- Maximum stress: 158 MPa
- Safety factor: 2.91



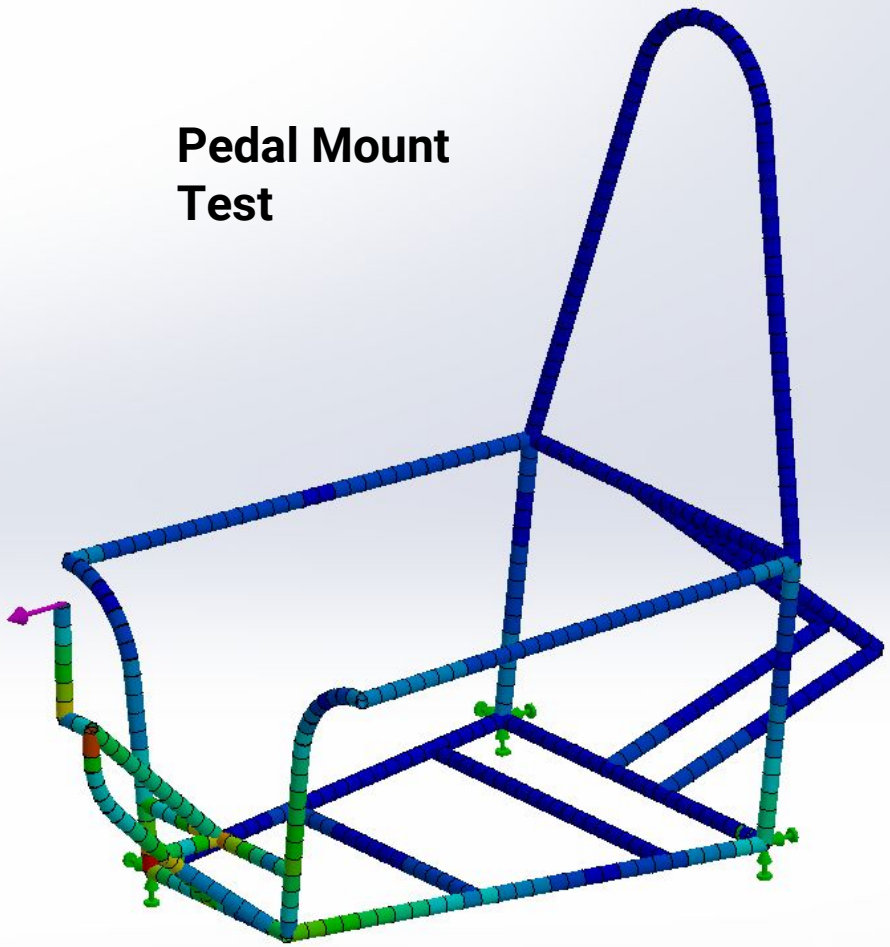
Yield Strength: 460 MPa

Chromoly Frame (cont.)

Pedal Mount Test:

300 lbf applied at pedal end

- Maximum stress: 289 MPa
- Safety factor: 1.59



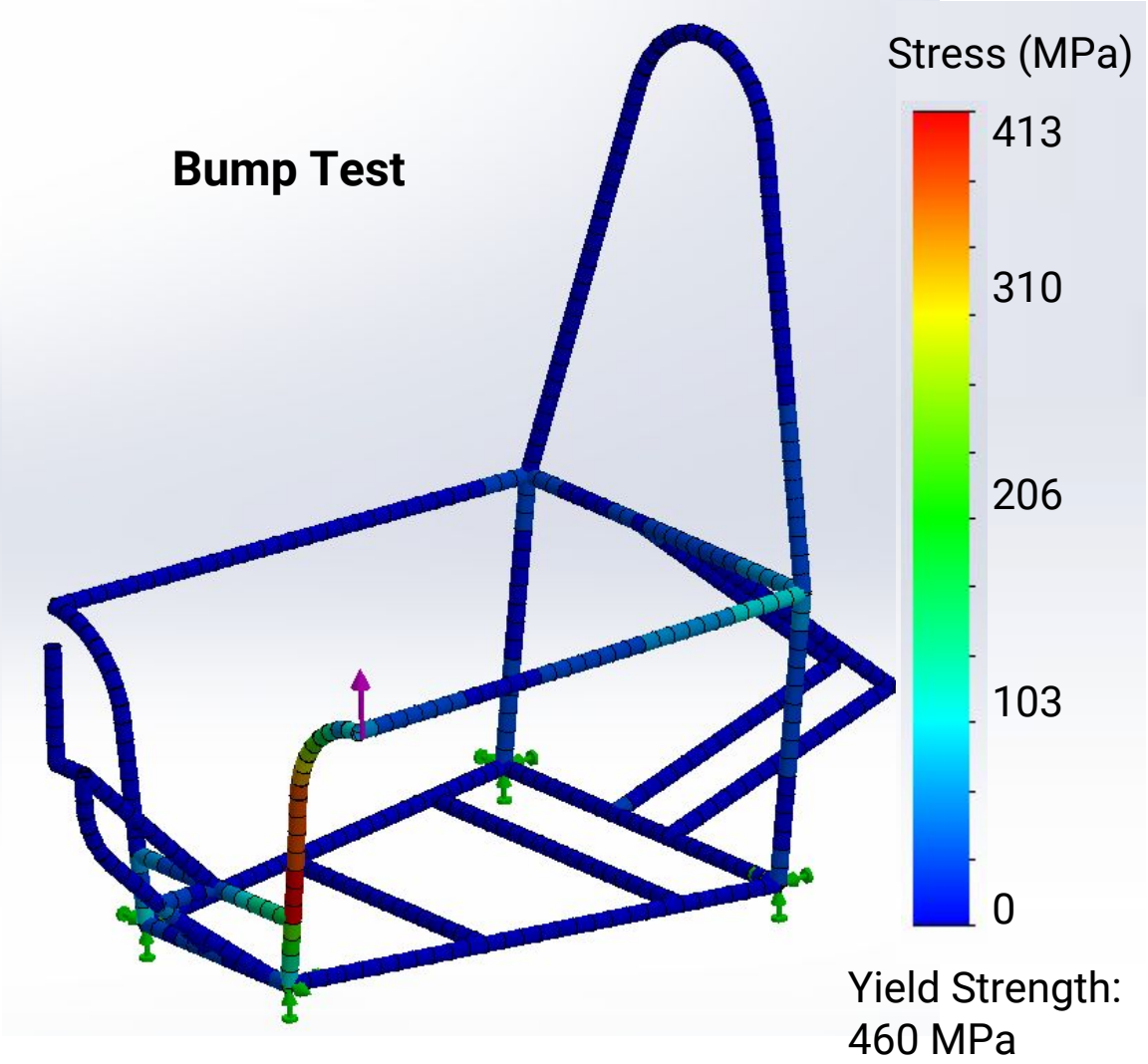
Yield Strength: 460 MPa

Chromoly Frame (cont.)

Bump Test:

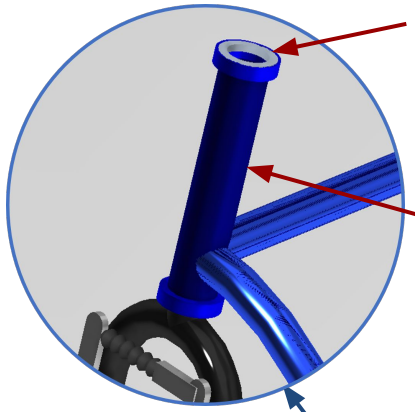
600 lbf applied at the front wheel mount

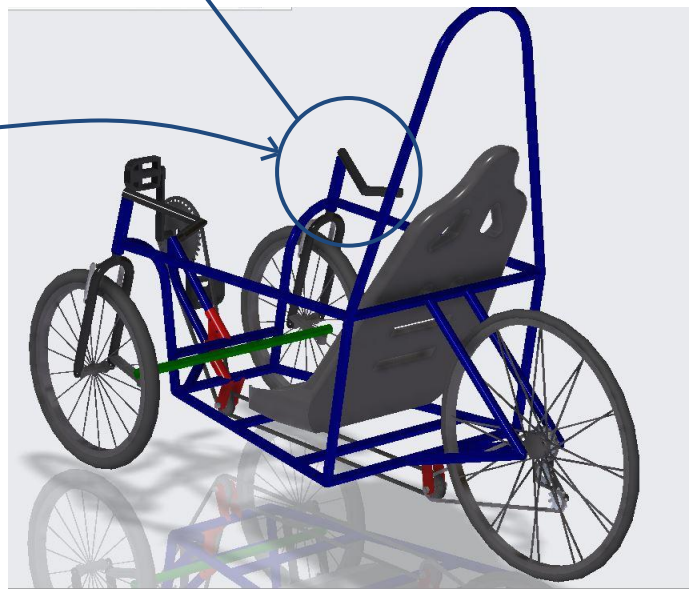
- Maximum stress: 413 MPa
- Safety factor: 1.11



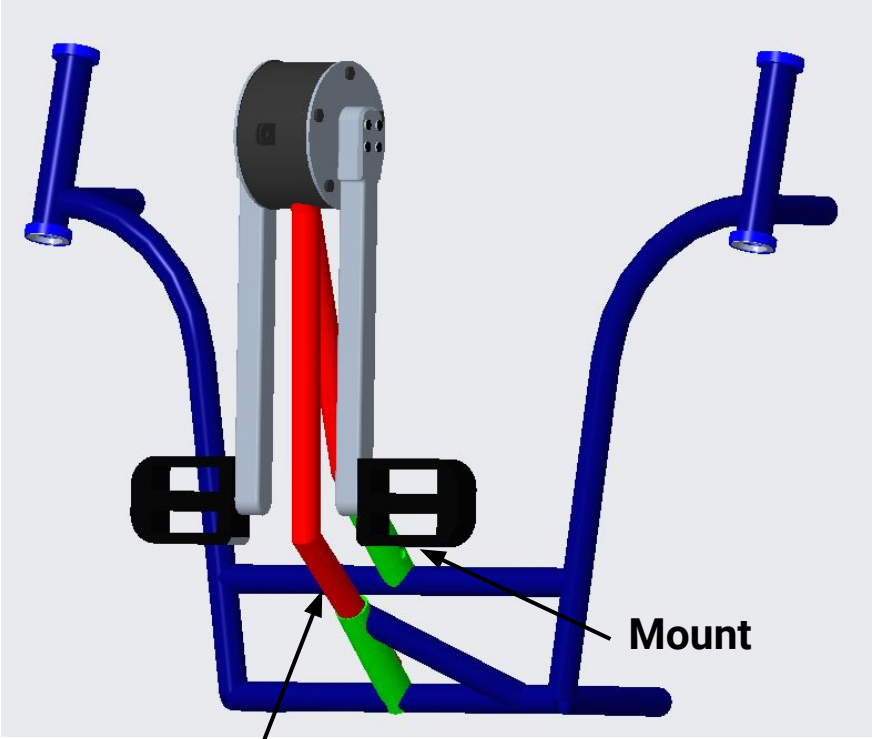
Steering

- Front Wheel Mounts
  - Same dimensions as front pivot tubes of standard bikes
  - Manufactured using 1.25” OD tube with .095” wall thickness
  - Bearing mounts welded on either end
- Tie Rod
  - Creates stability
  - Input from either handlebar can steer vehicle
  - Linkage is 2D and will only require pin joints

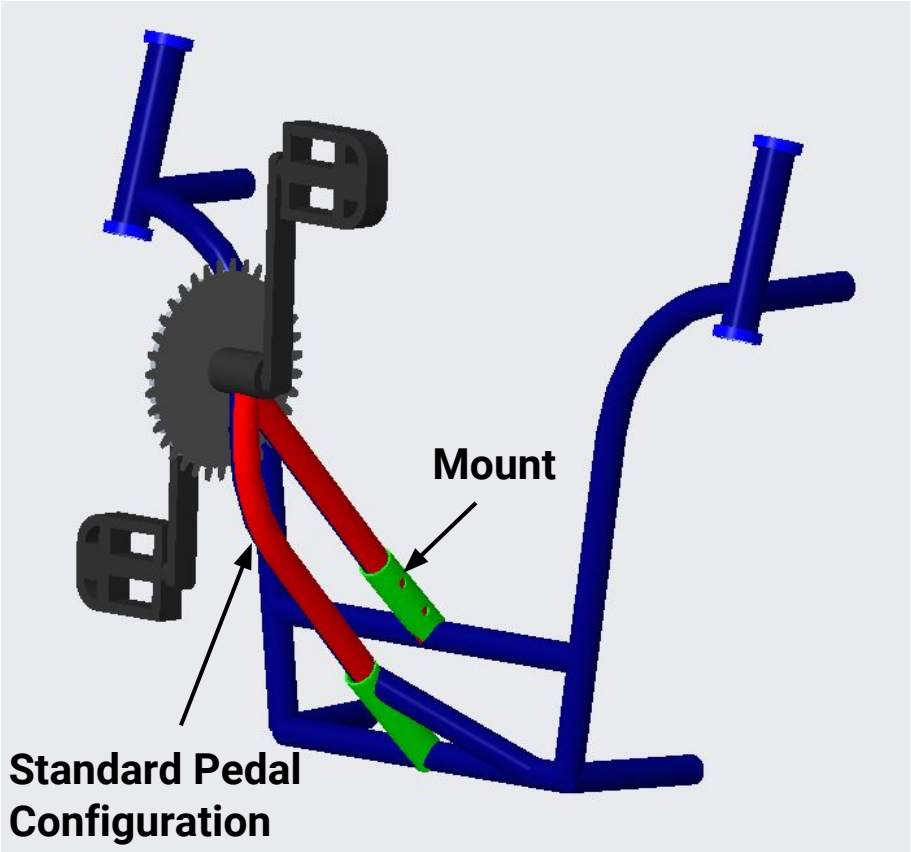




Interchangeable Pedal Mount



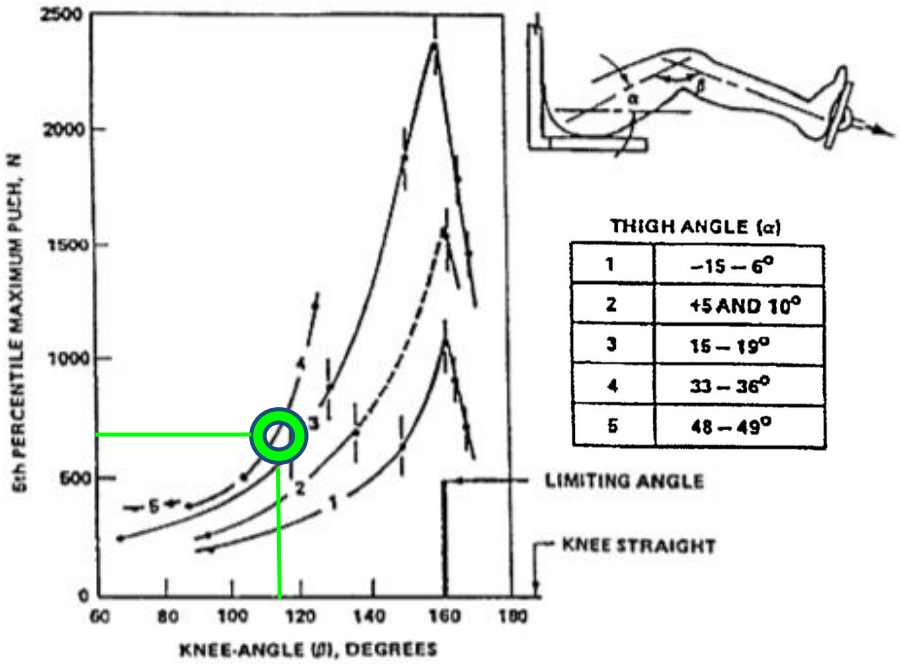
HANS Cycle Pedal Configuration



Standard Pedal Configuration

Seat and Rider Positioning

Leg Strength at Various Knee and Thigh Angles
(5th percentile male data) [1]

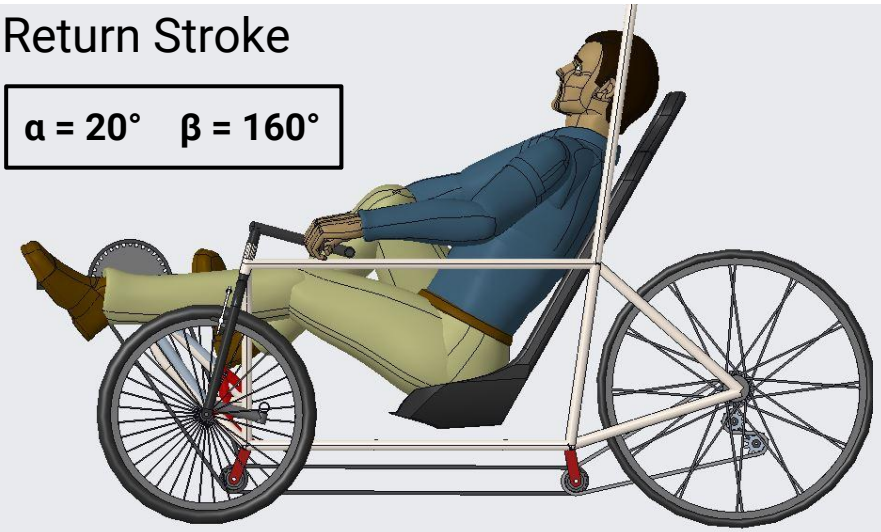


Goal: Determine seat angle and position for optimum force output during operation.

- With an alpha of 27° and beta of 114°, the force output is about 700N (*150lbf*)

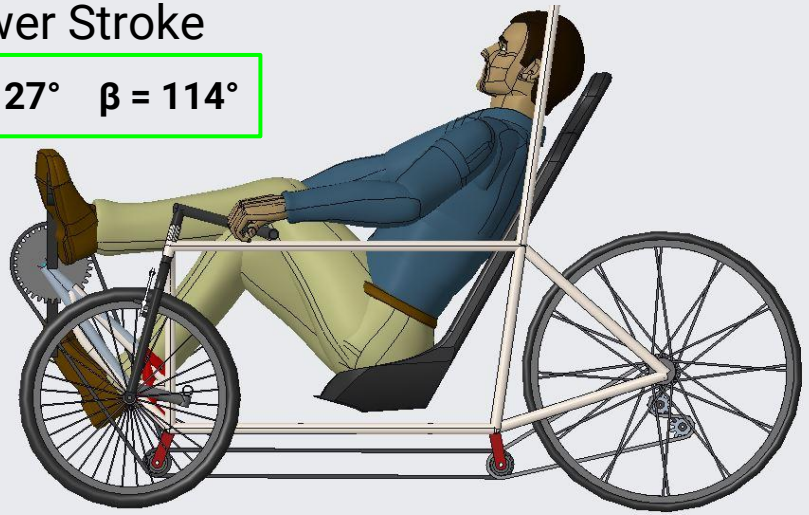
Return Stroke

α = 20° β = 160°



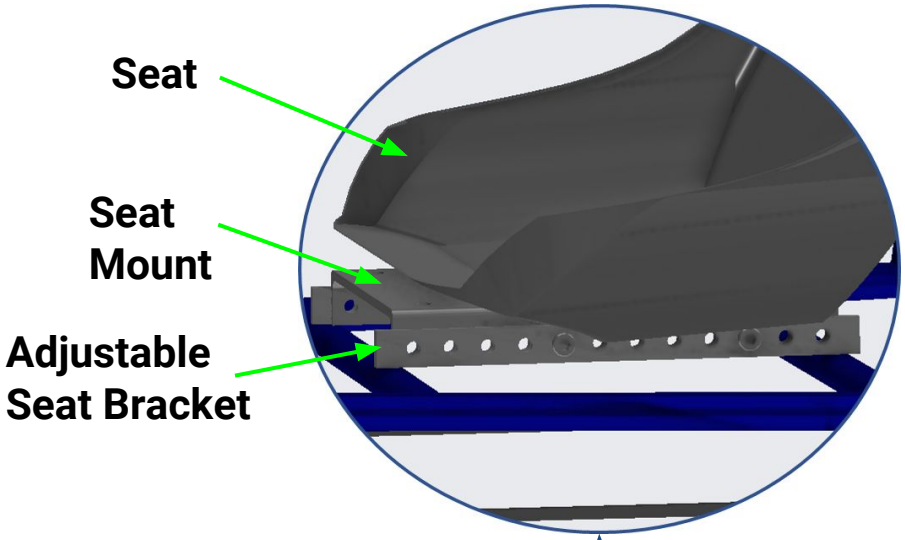
Power Stroke

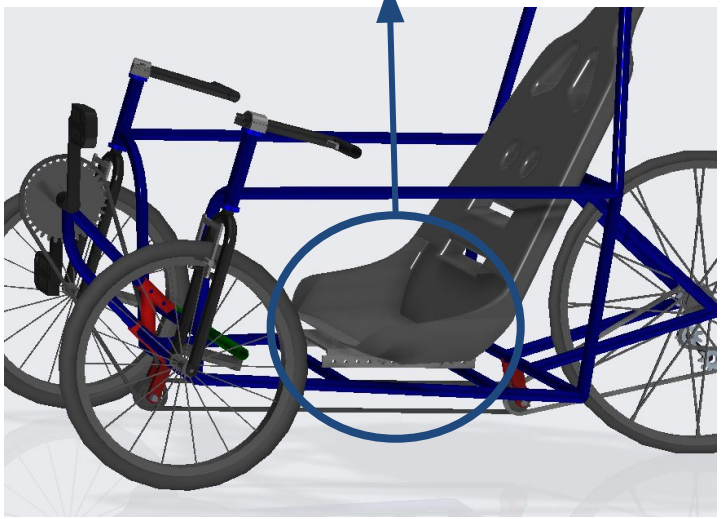
α = 27° β = 114°



Seat and Rider Positioning (cont.)

- Recumbent Seat
  - Sourced from reliable company (Niagara Cycles?)
  - Able to be mated to the seat mount
- Seat Mount
  - Interface between seat and adjustable seat bracket
- Adjustable Seat Bracket
  - Holes spaced at 1” intervals to accommodate different drivers
  - Design utilized from last year’s NASA Rover Team

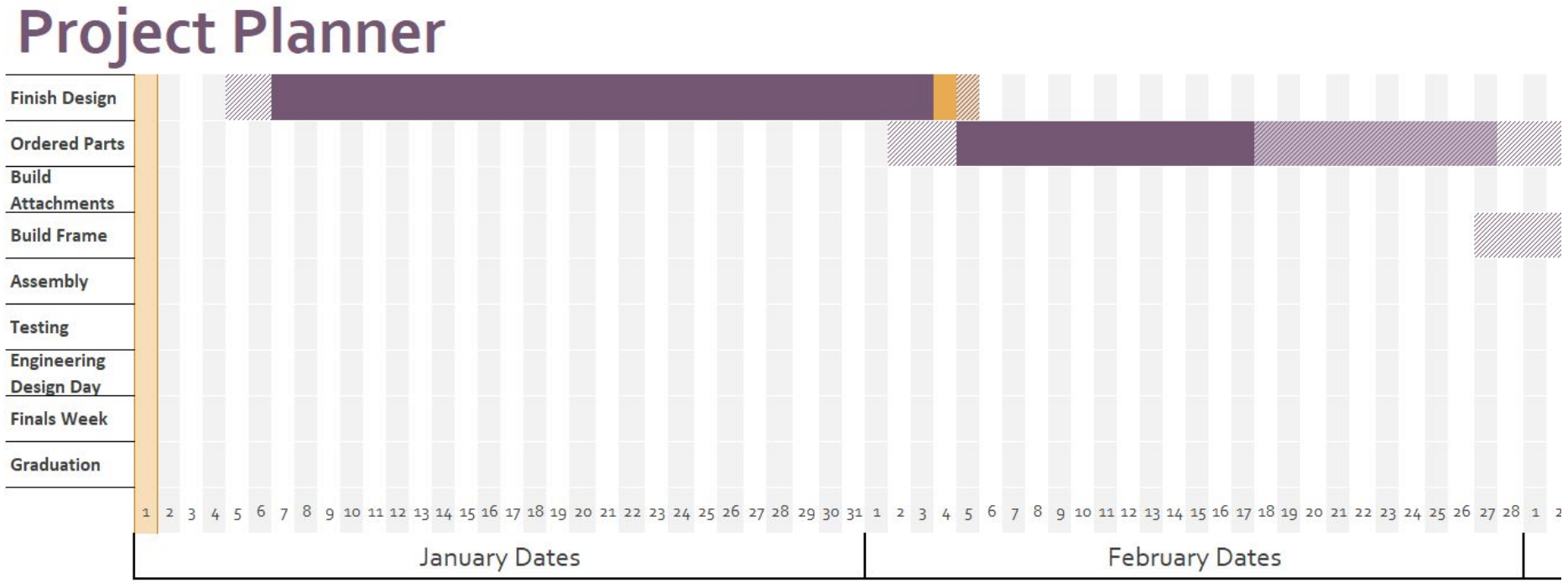




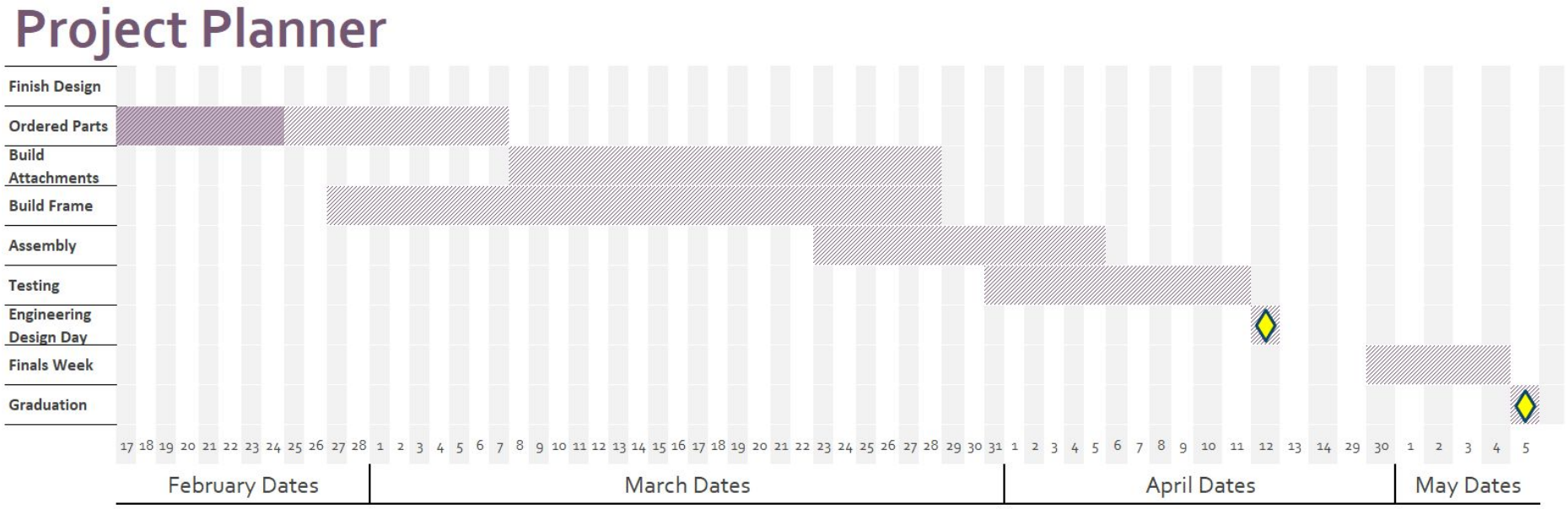
Future Planning

- Purchasing more materials
  - Bikes for front assemblies
  - Wheel for rear of vehicle
  - Other various parts
- Build frame
  - Make Jig for frame
  - Cut raw materials
  - Weld together
- Build Assemblies
  - Front wheel assemblies
  - Idler brackets
  - Adjustable seat brackets
  - Pedal brackets
  - Steering assembly

Gantt Chart Past Dates



Gantt Chart Future Dates



Budget Plan

- Total budget remaining: $925.07
- Two bikes from local bike shop
- What is left
  - Helmet
  - Metal for seat mount, adjustable mount bracket, etc.
  - Bikes that parts will be scavenged from
  - Idler gears and mounts
  - Bearing housings for front end assemblies
  - Ratchet mechanism for bike drivetrain

References

- [1] https://www.product-lifecycle-management.com/download/MIL-STD-1472F.pdf
- [2] https://www.mcmaster.com/#standard-metal-structural-tubes/=1bkgu1k

Questions?