Fluid Power Vehicle Challenge

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Design Objectives

Improve Frame Design
- Reduce weight
- Design component mounts
- Make pedal charging easier

Improve Hydraulic Circuit
- Safe/user friendly operation
- Add charging versatility
- Reduce friction energy loss

Competitors

Arizona State University
Cal Poly State University
Loyola Marymount University
Purdue University
Purdue University Northwest
South Dakota State University
Texas A&M
University of Denver
University of Akron
University of Louisiana at Lafayette

Necessary Gearing

Low Gear Ratio:
- Reduced Resistance Charging Accumulator
- Acceleration

Low Precharge PSI:
- Gradual Release of Accumulator

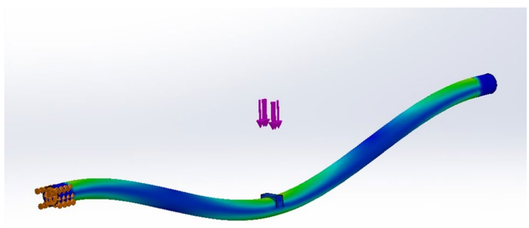
High Gear Ratio:
- Flow Rate

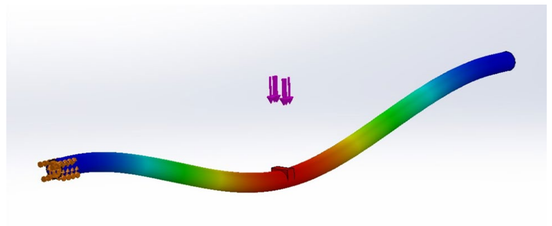
High Precharge PSI:
- Volume and Pressure Balance
- Decreased Accumulator Release Time

FEA Analysis

Maximum Stress: 70 MPa

Maximum Deflection: 3mm





New Pedal Design

SPD Clip-in pedals
- More efficient pedal stroke
- Better stability
- Easier transfer of weight

Acomplishments

1st Place: 2022 Nation Fluid Power Vehicle Challenge

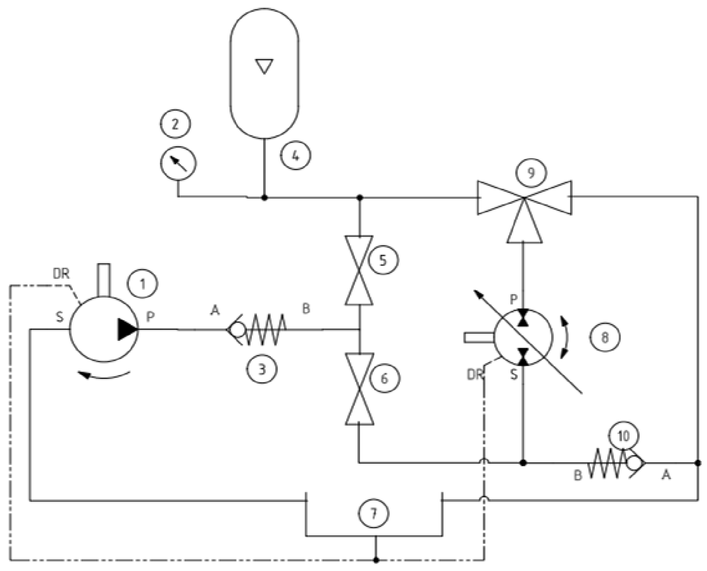
- **Top Speed: 50mph @1000 PSI precharge**
- **Curb Weight: 160 lb**
- **Full Throttle Efficiency: 11%**

Special thanks and gratitude to Bogdan Kozul, Steven Gluck, and Ernie Parker for their tireless help and invaluable knowledge.

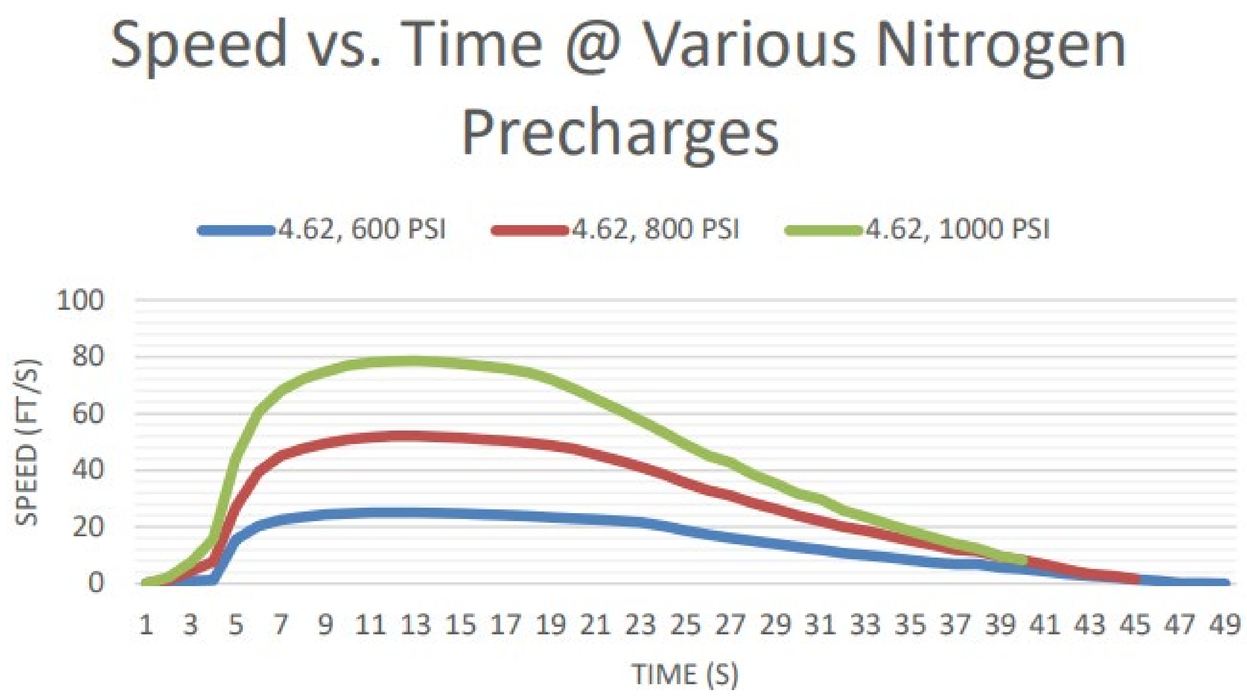
Hydraulic Circuit

Modes of Operation:
- Pedaling Drive
- Accumulator Drive
- Charge by Pedaling
- Discharging Accumulator
- Regenerative Braking

Featured Components:
- 1 Gallon Accumulator
- (2) Parker F11 Hydraulic Pumps/Motors
- 3 Gallon Aluminum Hydraulic Reservoir
- 7250 PSI Rated 3-way Ball Valve



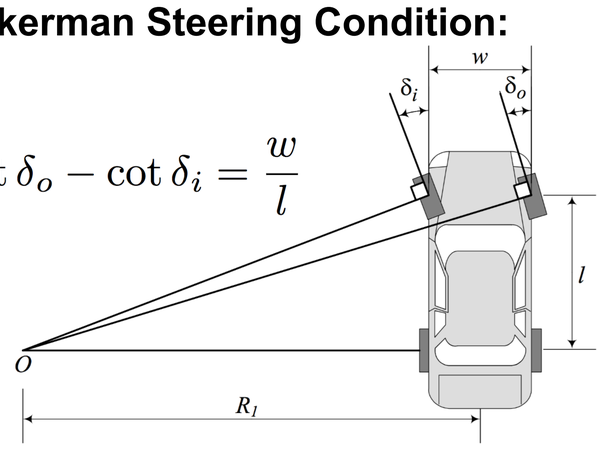
Performance Testing



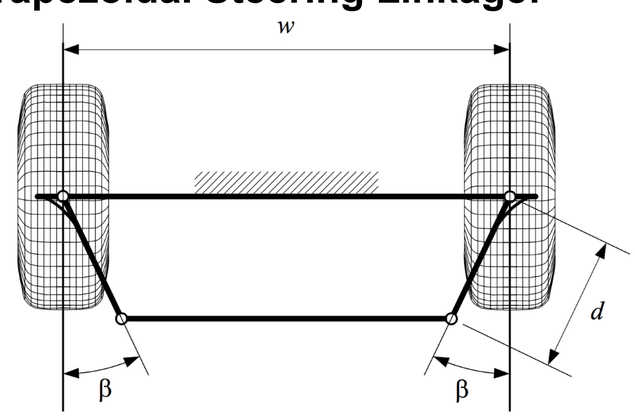
Steering Mechanism

Ackerman Steering Condition:

$$\cot \delta_o - \cot \delta_i = \frac{w}{l}$$



Trapezoidal Steering Linkage:



Jazar, R. N. (2019). Advanced Vehicle Dynamics. Cham: Springer International Publishing.