NFPA Fluid Power VEHICLE Challenge

NFPA Education and Technology Foundation

FINAL PRESENTATION
ARIZONA STATE UNIVERSITY
Wenlong Zhang
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Introductions

Dave Harden, Andrew Peavler, Jacob Delacruz, Logan West, Jerred Hermogino, Akhil Johnson, Hala Mayyas, Matthew Seddon, Wenlong Zhang

Introductions

- Dr. Wenlong Zhang
  - ASU Mentor
  - Worked with previous years team
- Jonathan Bush
  - Graduate student
- Zhekang Du
  - Industry Professional
  - Danfoss

Design Objectives

- Optimize vehicle for efficiency
- Achieve a speed of at least 10 MPH
- Keep vehicle weight under 210 lbs

Progress since midway

- Implemented regenerative braking
- Vehicle construction
- Vehicle testing
- Swapped solenoids for ball valves

Summary

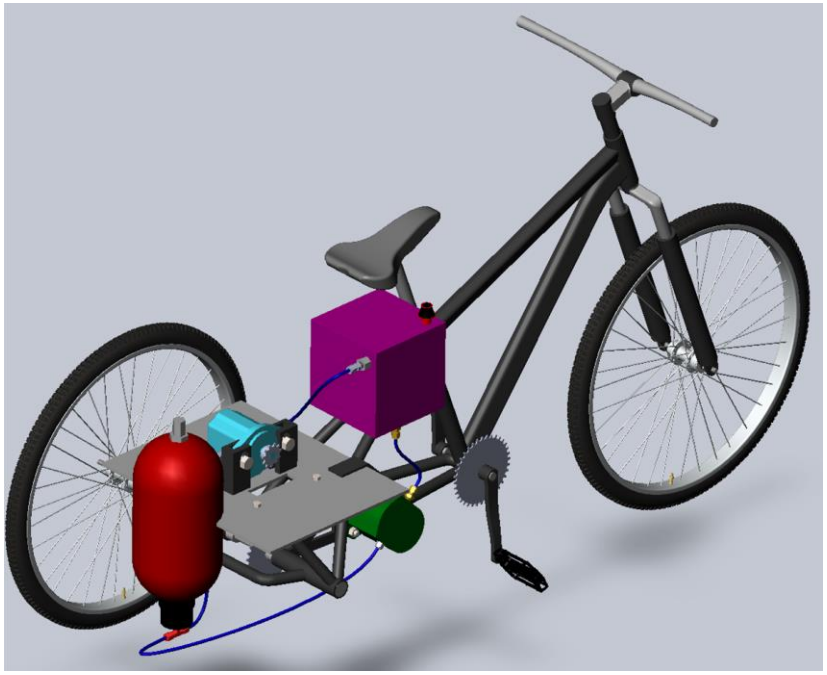


Figure 1: Midway Design Concept

Figure 2: Final Design Concept [1]

Summary

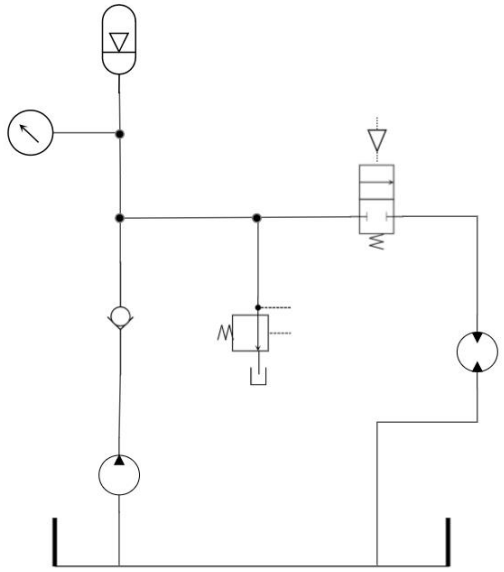


Figure 3: Midway Circuit Design

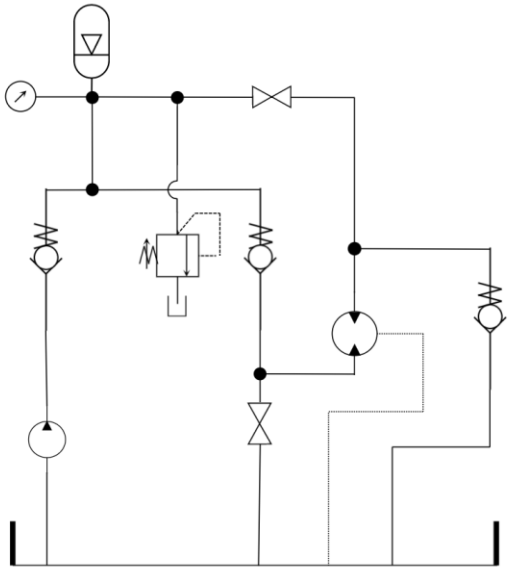
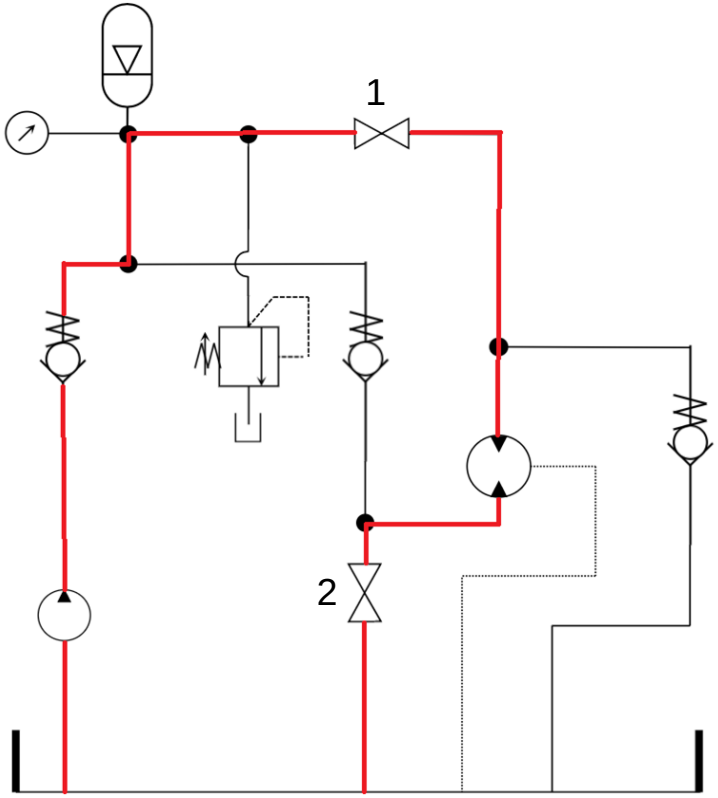


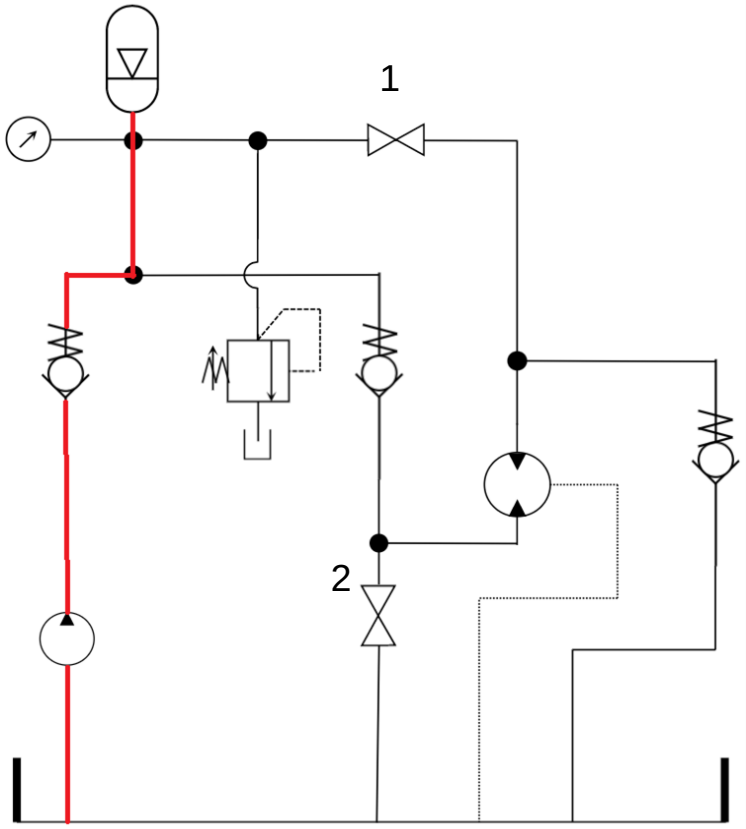
Figure 4: Final Circuit Design

Direct Drive Schematic



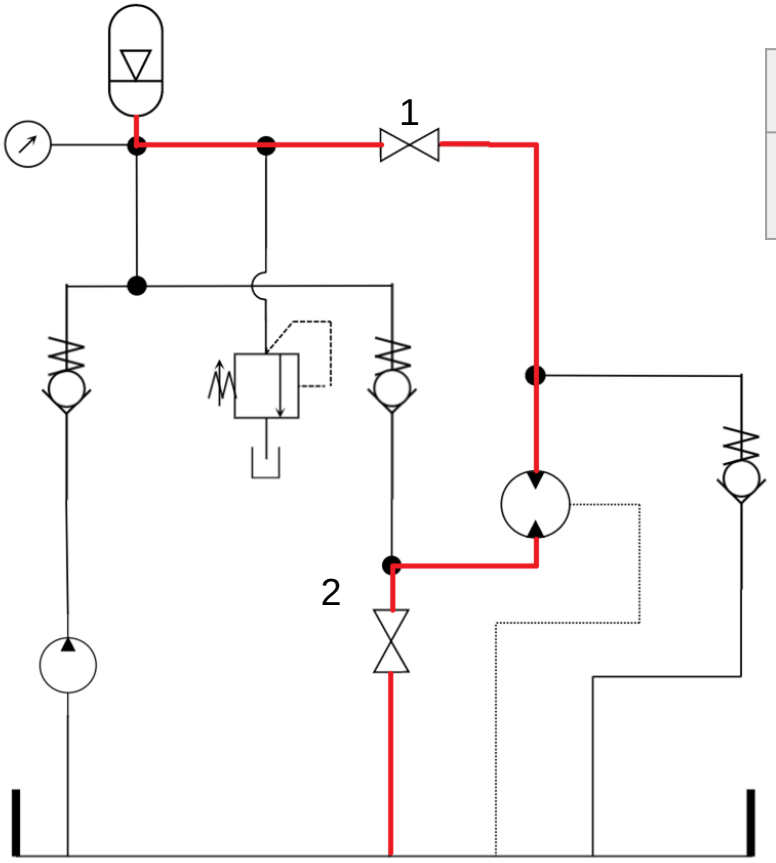
Ball Valve #1	Open
Ball Valve #2	Open

Charged Drive Schematic



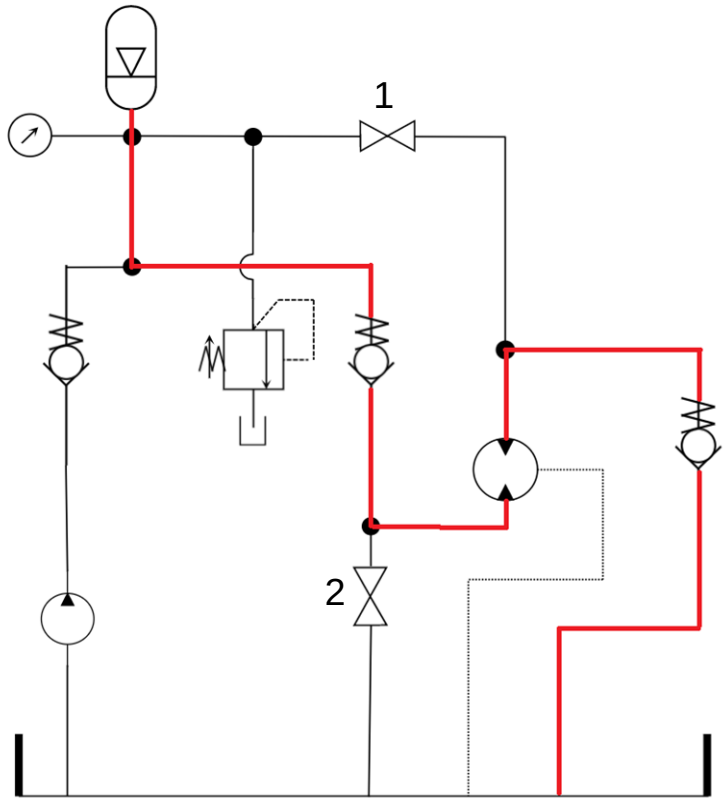
Ball Valve #1	Closed
Ball Valve #2	Open

Discharge Drive



Ball Valve #1	Open
Ball Valve #2	Open

Regenerative Drive Schematic



Ball Valve #1	Closed
Ball Valve #2	Closed

Vehicle Design

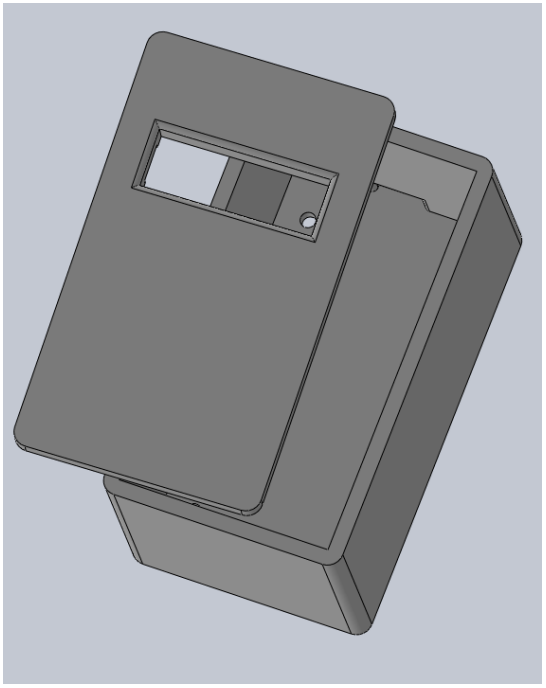


Figure 5: LCD display box

Figure 6: Final design concept

FEA

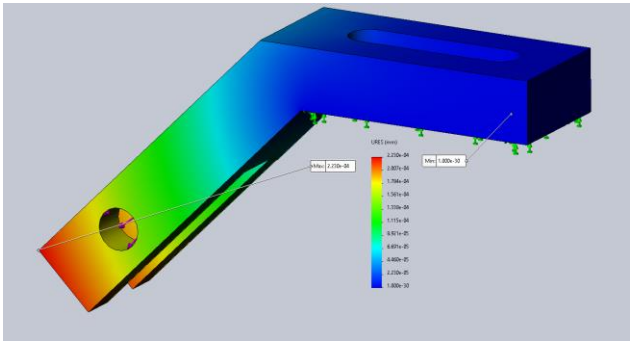


Figure 7: Pump Mount Deformation

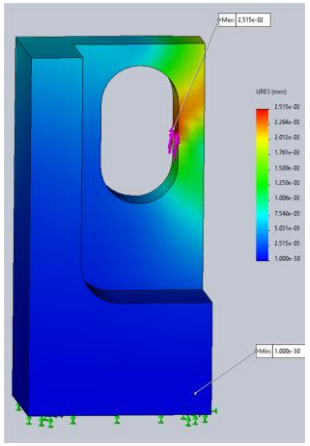


Figure 8: Motor Mount Deformation

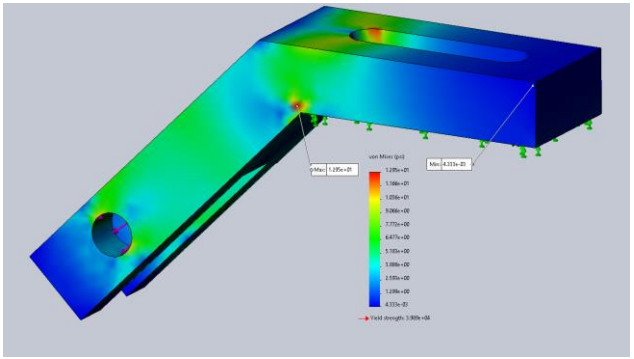


Figure 9: Pump Mount Stress

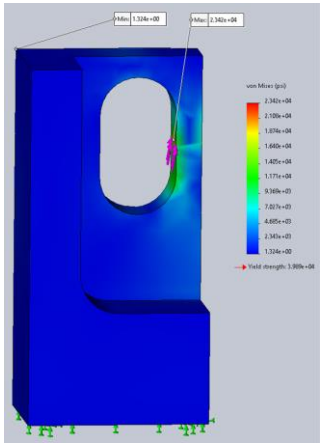
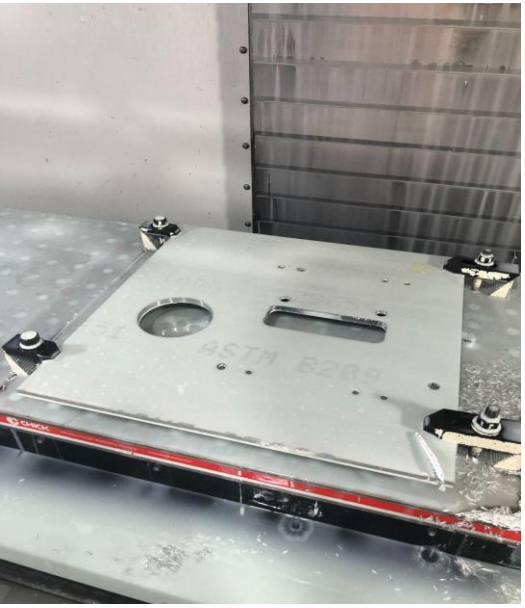
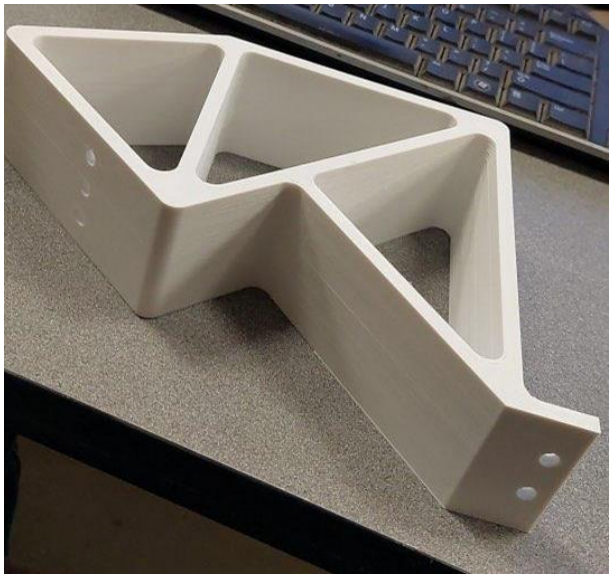
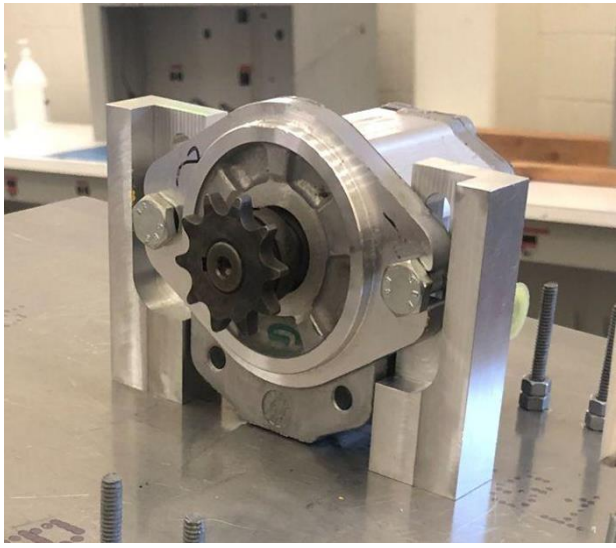


Figure 10: Motor Mount Stress

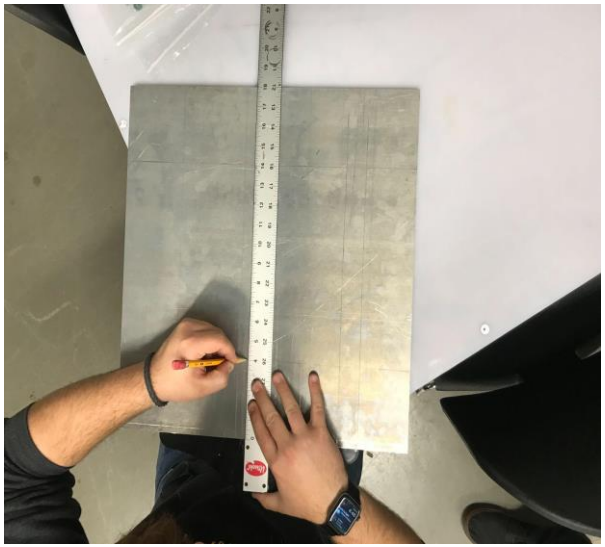
Vehicle Construction

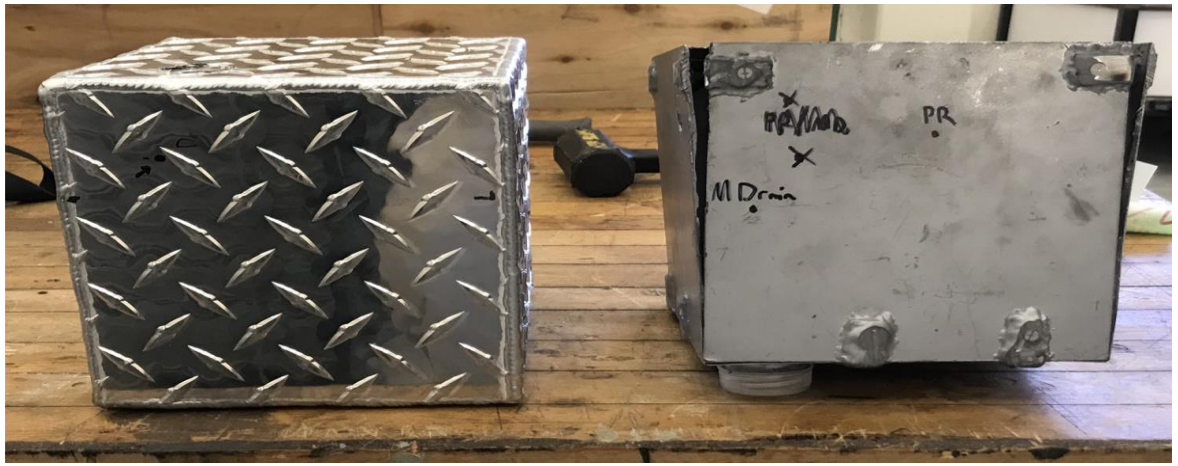






Vehicle Construction





Final Concept

- Weight - 250 lbs with fluid and rider
- Top speed - 11 MPH
- Accumulator pressure - 350 psi
- Oil volume - 1 gallon
- Distance traveled - 764 feet
- Efficiency - $E = \frac{W*L}{P*V}$

E = 28.37

Vehicle shipment

Lessons Learned

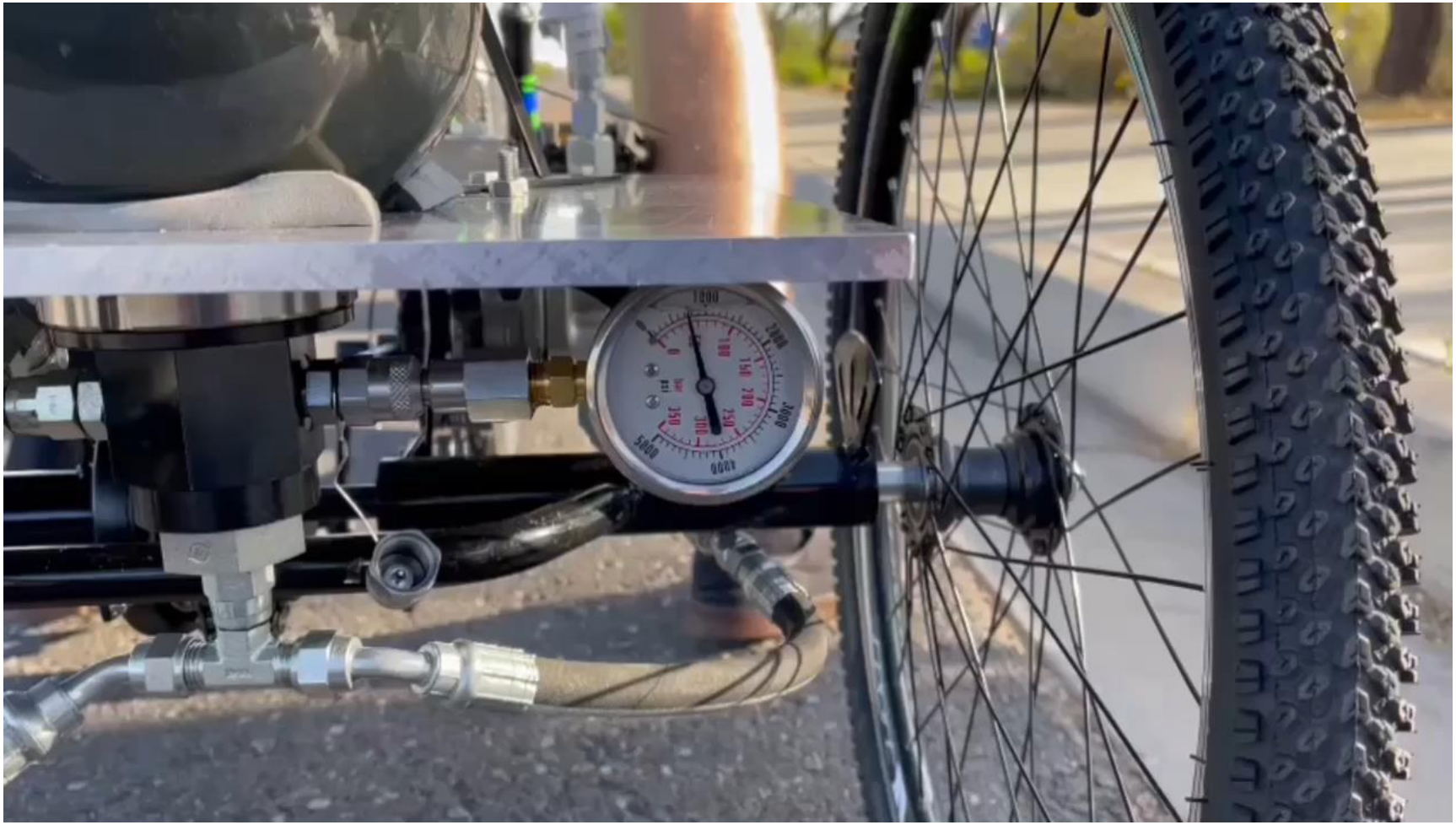
- Use a manifold
- Allow significant time for testing
- Strengthen brakes
- Switched to ball valves for efficiency

Questions?

Thank you:

NFPA, Ernie Parker, Zhekang Du, Stephanie Scaccianoce, Sunsource, Danfoss and all others who contributed to the project's success.

Questions?



References

[1] CAD man - http://mreed.umtri.umich.edu/mreed/index.html