NFPA Fluid Power Vehicle Challenge

NFPA Education and Technology Foundation

Ohio University
Final Presentation
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OHIO UNIVERSITY
Russ College of Engineering and Technology

Team Members

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Team Members

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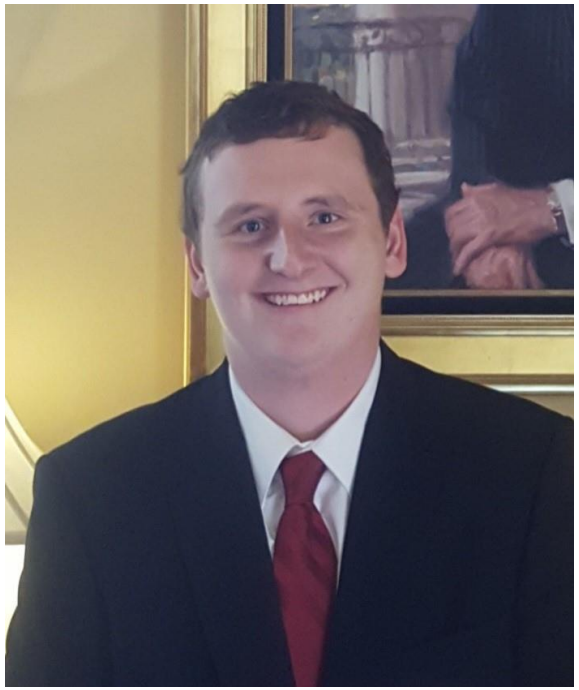

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Team Members

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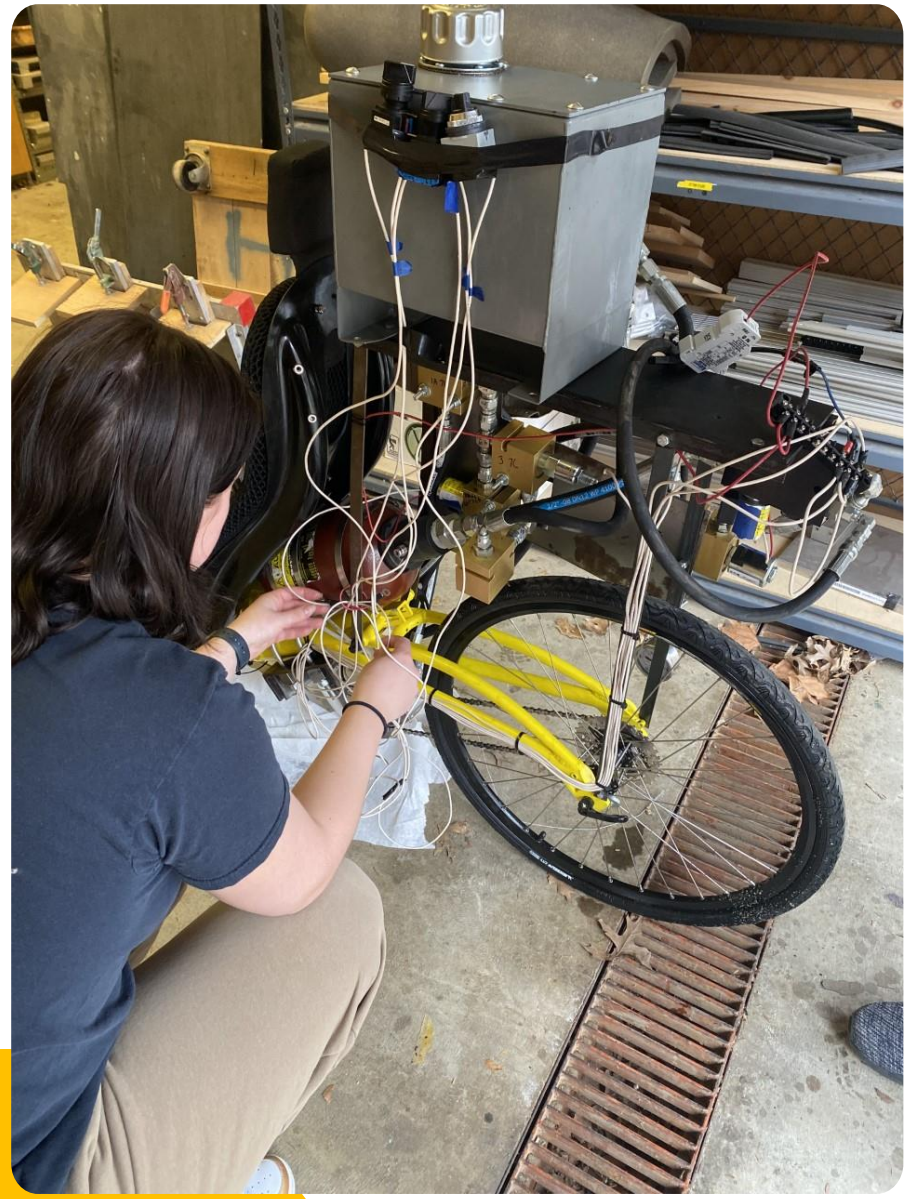


Team Overview

- Throughout the year, we have cycled through three sets of teams. Our current team was handed this project three weeks ago. We knew we had a lot of work to do to create a functioning bike with very little time.

Obstacles

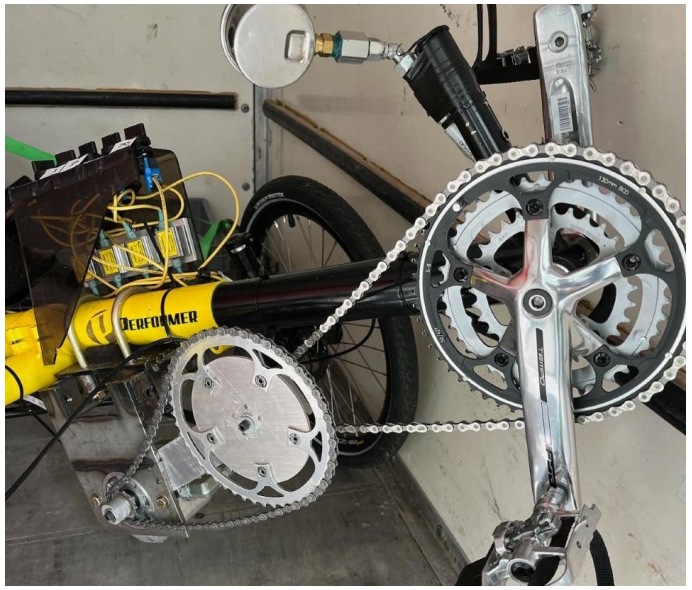
Jumping Chain
Resistance when pedaling due to over sized pumps
Wiring from previous years was opening solenoid and interacting with accumulator unexpectedly
Need to increase RPM for gear pump to function more efficiently
Chain and sprockets unreliability under load
Pre-charge was based on initial design without any gear ratio

Components Used

- Danfoss External Gear Pump
- NOCO NLP30 700A 12V 8Ah Lithium Powersport
- Eaton Solenoid Valves and Coils
- Sauer Danfoss Hydraulic Gear Motor

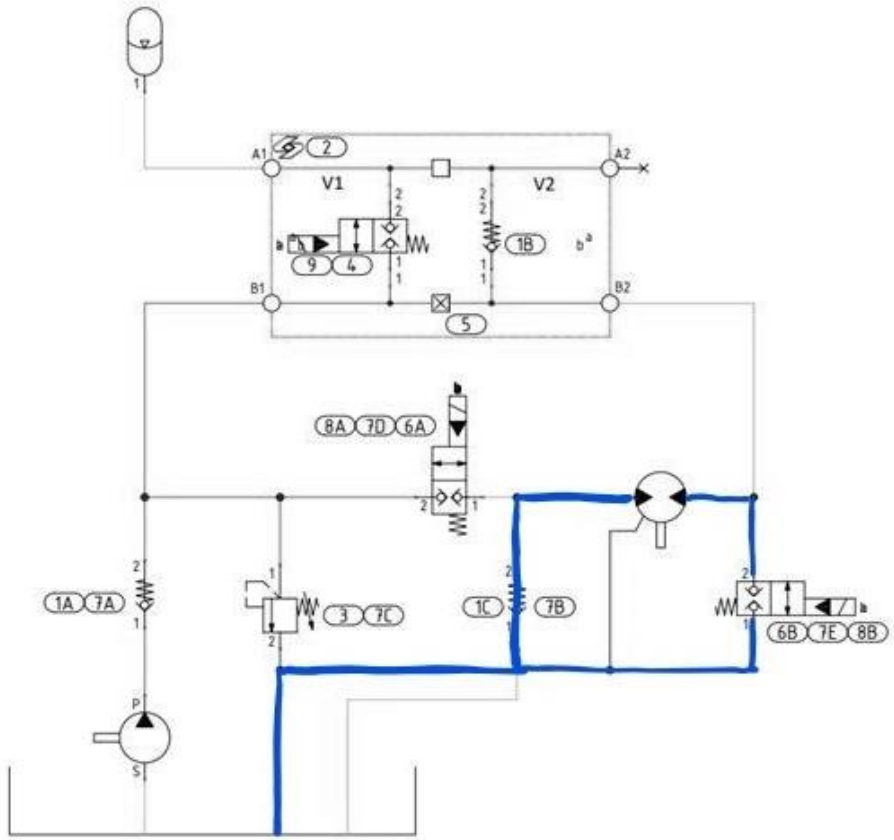
Functionality

- The pedals gear up and flow to the pump.
- There is then a hydraulic link from the pump to the motor
- Then from the motor it is geared down to the wheel.

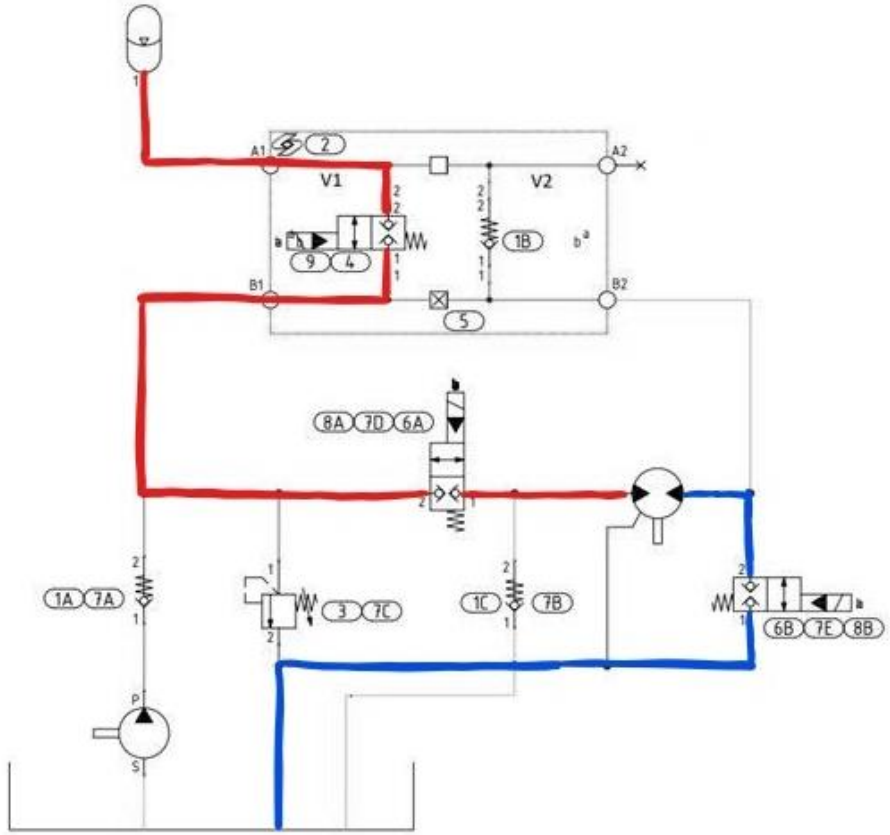


Gears

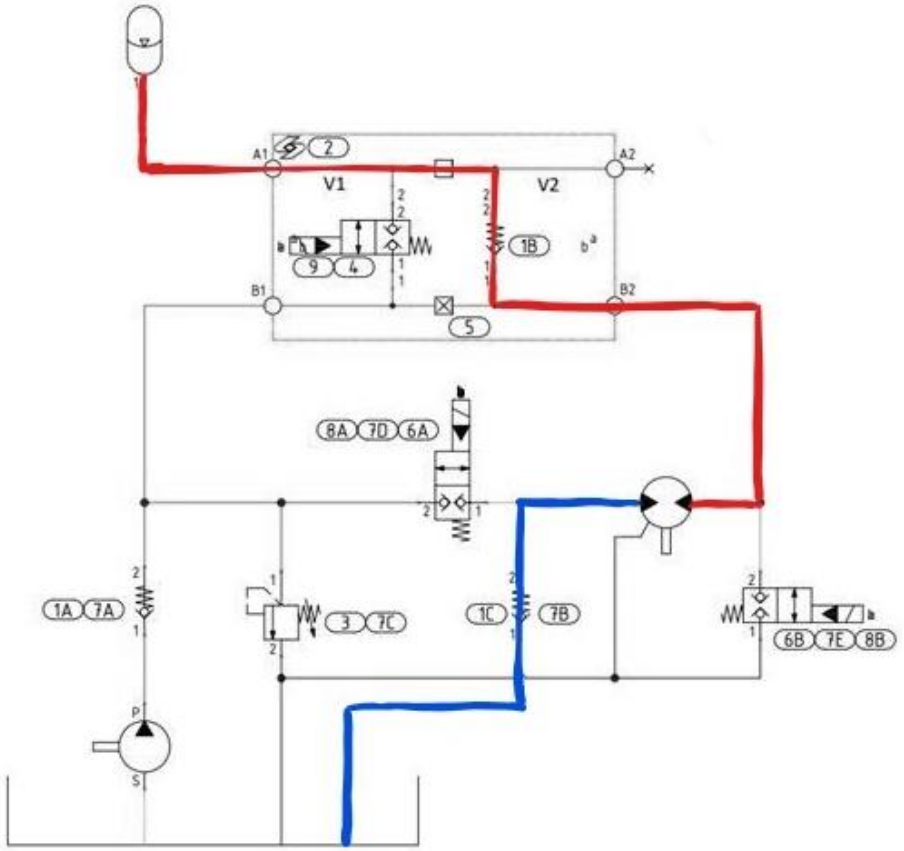
- Most gears cut on a water jet
  - 6061 T6 AL and 1020 steel
- Gear Ratio
  - 5.4 : 1 on the front
  - 1 : 5.7 on the rear wheel
- Pump/Motor RPM: 270 (at 50 RPM pedal speed)



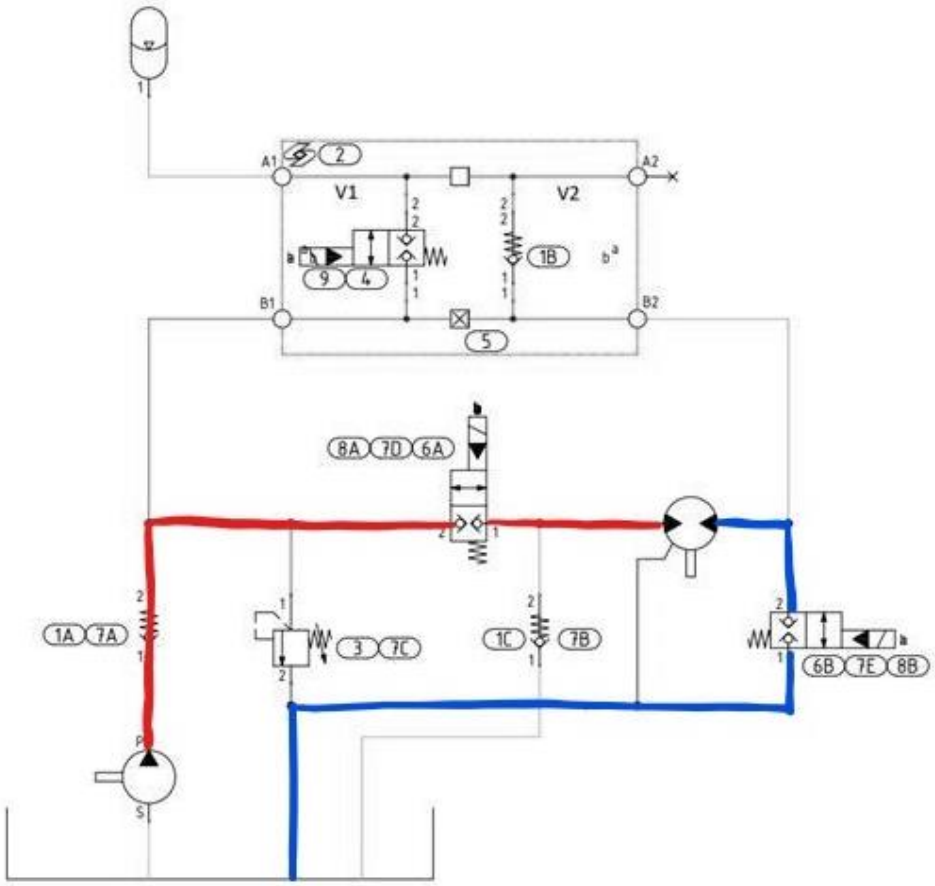
Coast



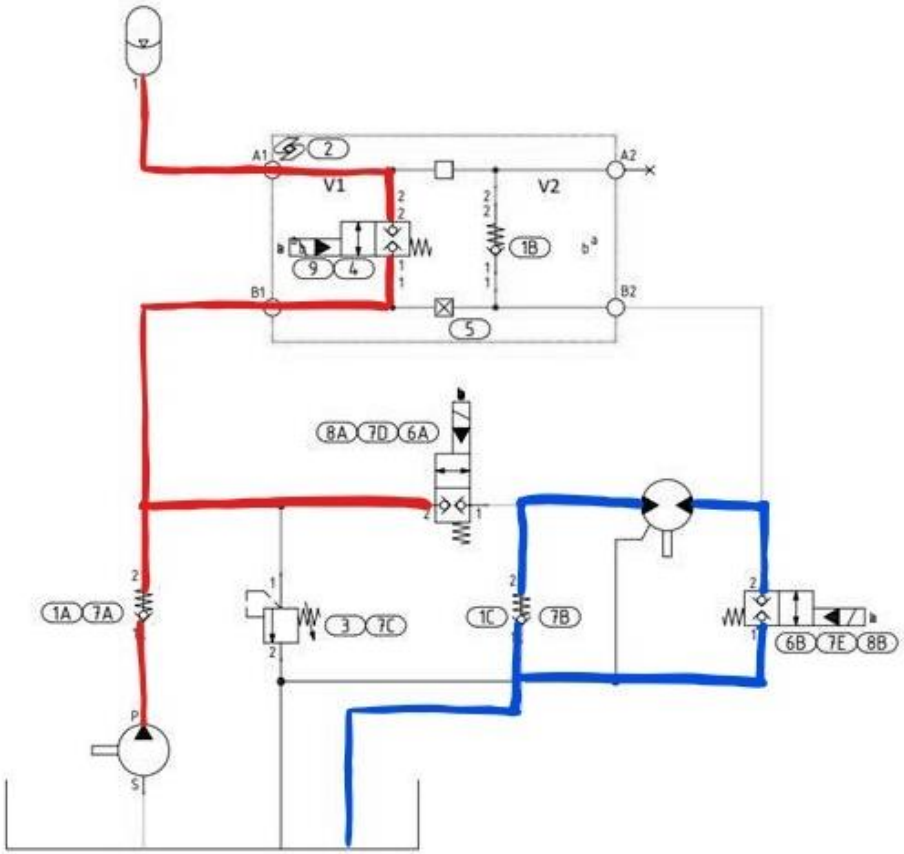
Accumulator Power



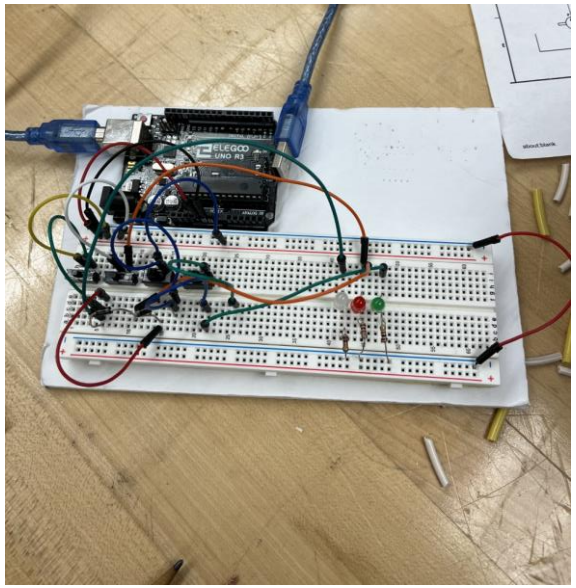
Regenerative Braking

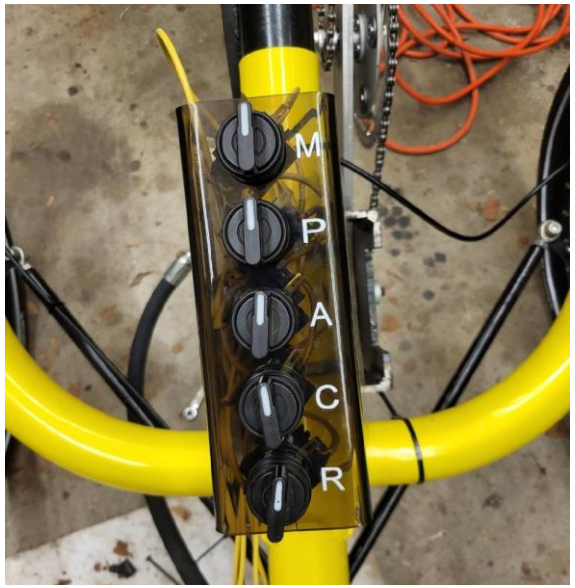


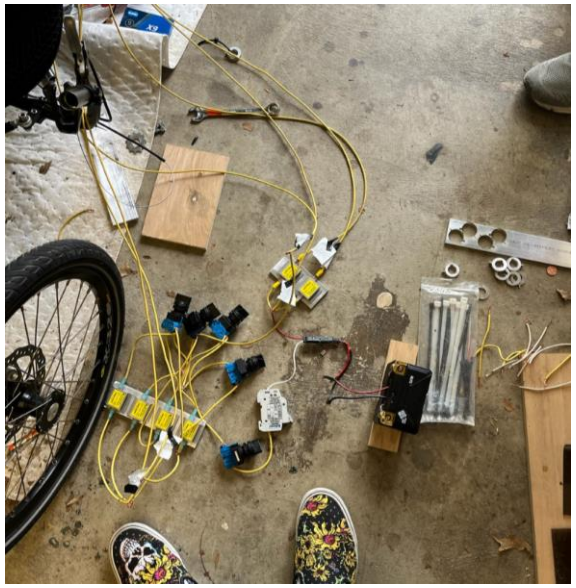
Pedal Power

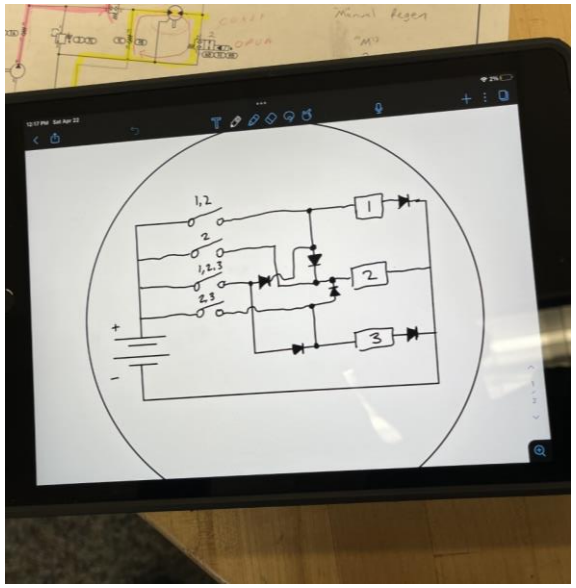


Manual Regenerative









Electrical

Accomplished Goals

- Placement for circuit switches
- Placement for new battery
- Placement for gauges to be viewable
- Design and created gear sets
- Fix accumulator for proper function
- Understand hydraulic circuits
- Gear ratio
- Pre-charge

Future Improvements

- Switch from normally closed to normally open Solenoids to reduce power draw
- Use logic controllers (Arduino, Raspberry Pi)
- Reduce weight of the bike
- Better location for battery and accumulator
- Better gear system

Lessons Learned

- Learning : Pedal positioning
- Solution : Change the design of the frame to allow for the rider to pedal easier and allow for better gear positioning

- Learning : Additional gear ratio sets for quick fix
- Solution : Acquire correct specs for pump and motor to avoid the need for the extra gear sets

- Learning : Normal bike chains created challenges with jumping chains
- Solution : Use industrial chains

- Learning : Placement of accumulator
- Solution : Place accumulator in a more accessible place for easy access

Lessons Learned

- Learning : Ability to coast
- Solution : Ability to engage/disengage rear hub

- Learning : Need to take advantage of accumulator volume and pressure
- Solution : Increase pressure of the system pressure

- Learning : Adjustability of discharge for accumulator
- Solution : Control the rate of flow out of the accumulator so it isn’t a sudden rush of pressure/flow. This damaged our drive components

Questions?