NFPA Fluid Power VEHICLE Challenge

NFPA Education and Technology Foundation

FINAL PRESENTATION
The University of Akron
Dr. Scott Sawyer
April 16th, 2020

Presentation Overview

- Team Introduction
- Problem Statement & Objectives
- Summary of Midway Presentation
- Vehicle Construction
- Progress Towards Final Vehicle
- Lessons Learned & Conclusion

The University of Akron Team

- Team Members:
  - Ted Nichols
  - Ross Kohar
  - Bailey Codispoti
  - Jonathon Giaquinto
  - Brady Speicher

- Advisor: Dr. Scott Sawyer
- Mentor: Steve Gluck

Problem Statement and Objectives

- Design a custom vehicle utilizing hydraulic components to compete in The Fluid Power Vehicle Challenge
  - Sprint Race: 600 feet time trial.
  - Efficiency Race: Travel maximum distance using pressurized accumulator from a stop.
  - Endurance Race: A 1 mile time trial.

Summary of Midway Presentation

- Design Objectives
- Vehicle Design
- Circuit Design
- Selection of Hardware
- Calculations and Results

Design Objectives

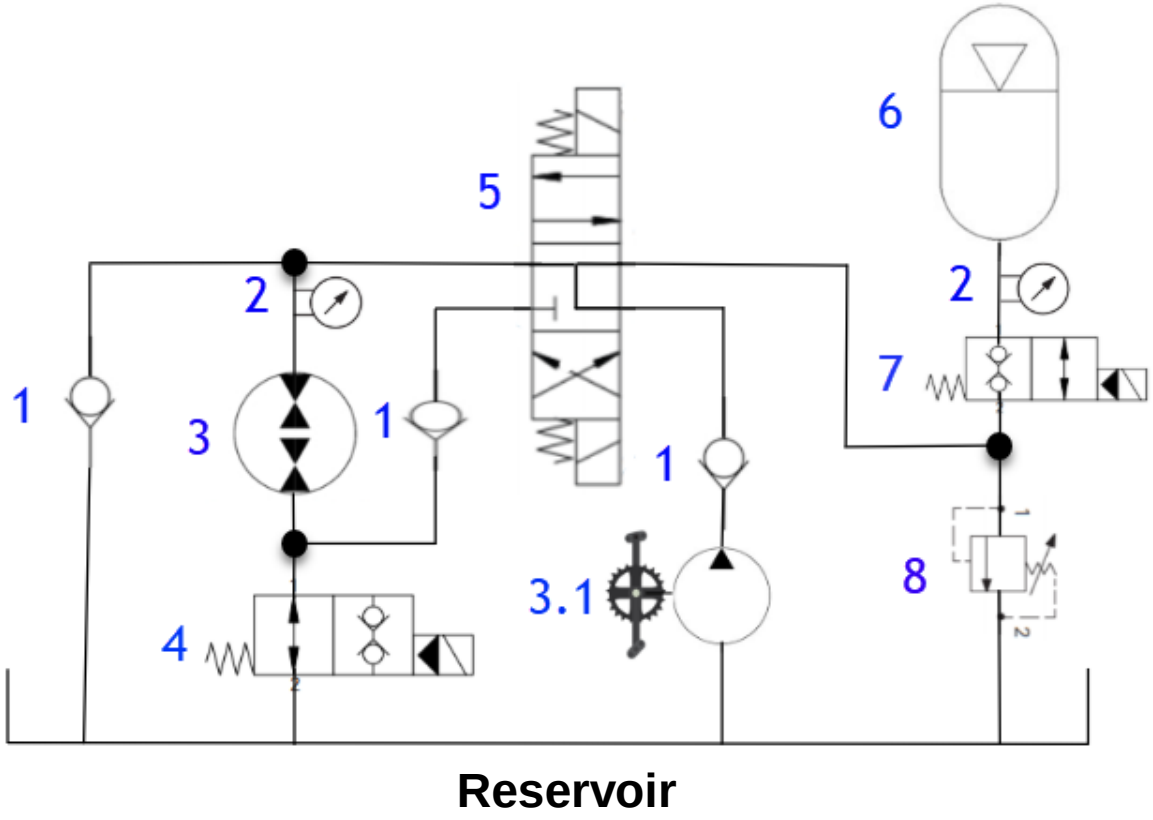
1. Frame Selection
2. Minimize Components
3. Consider Future Team's Success

Vehicle Design

Initial Bike Design → Final Bike Design

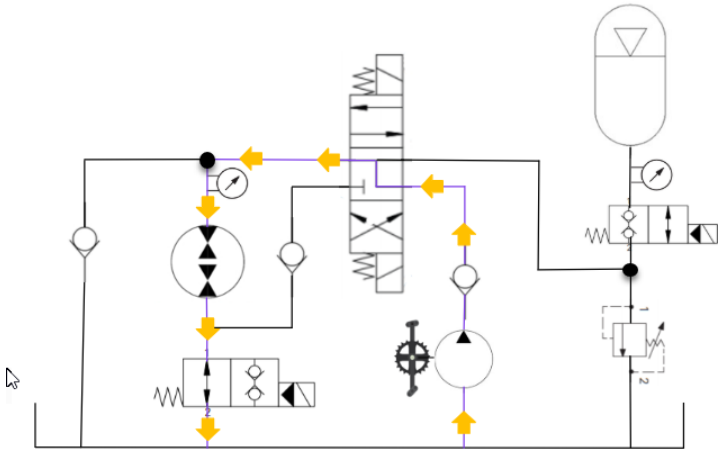
Circuit Design

Circuit Legend	
1	Check Valve
2	Pressure Gauge
3	F11-5 Pump/Motor
4	SV9-10-F
5	SBV11-10-0
6	Accumulator
7	SBV1-10-C
8	Pressure Relief Valve

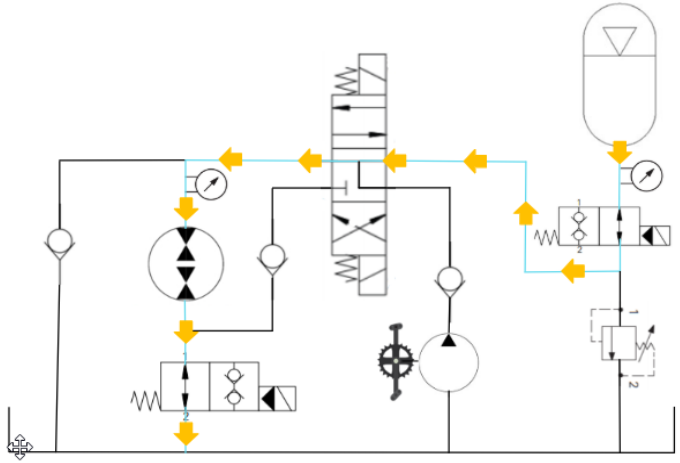


Drive Circuits

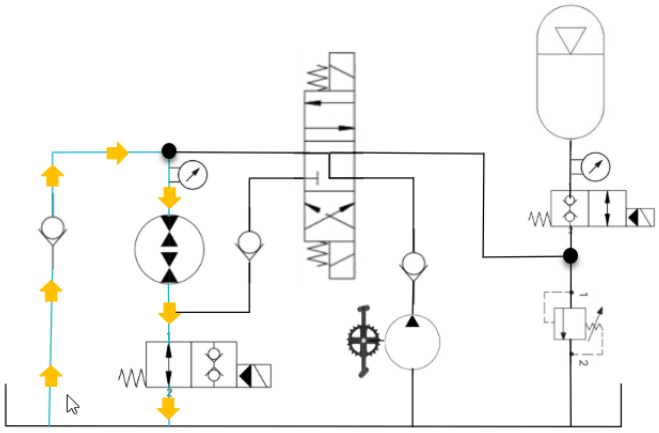
Pedal Circuit



Discharge Circuit

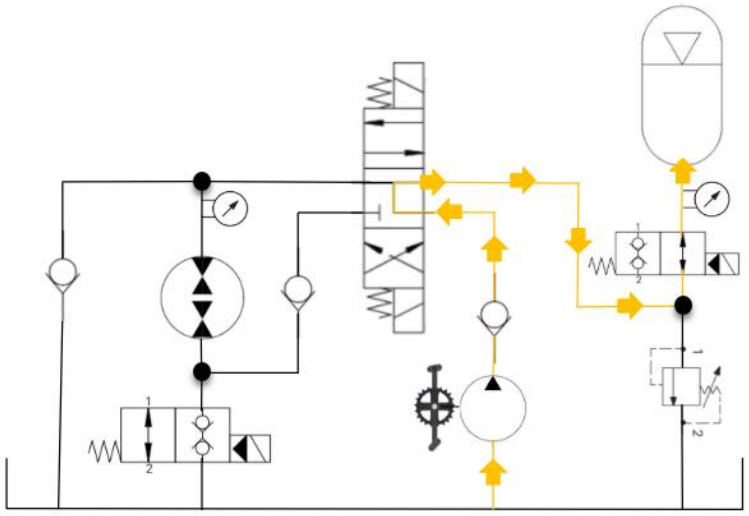


Coasting Circuit

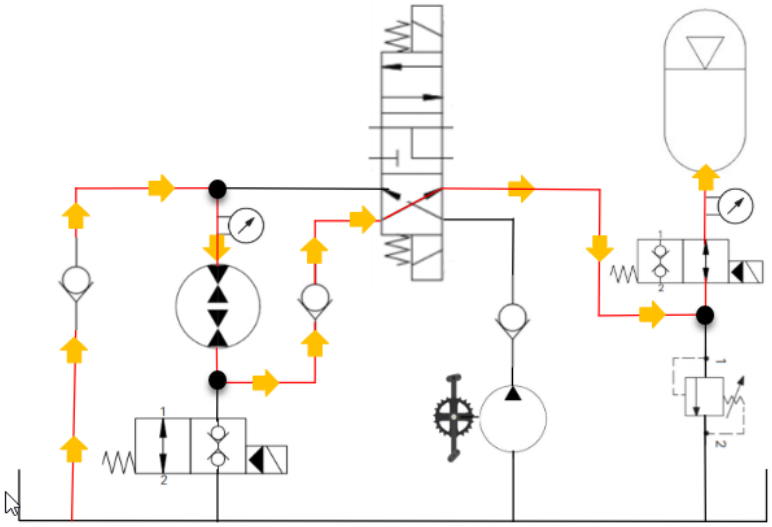


Regeneration/Charging Circuits

Pedal Charge Circuit

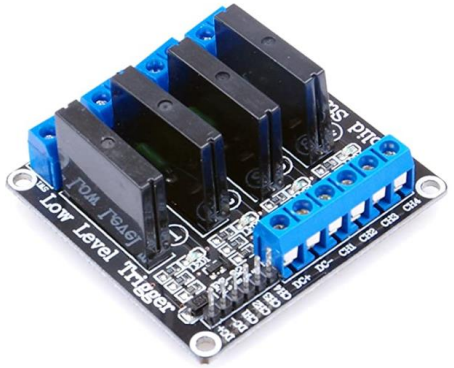


Regenerative Braking Circuit



Controls System

Arduino UNO



Solid State Relay

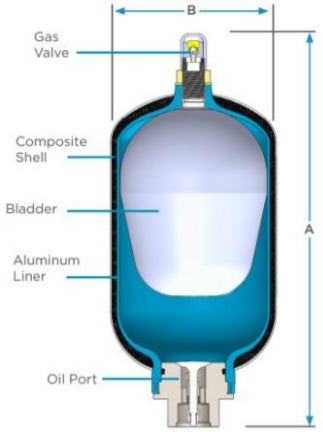
Core 40V Battery

Switches

Hardware Selection

Planned Hardware:

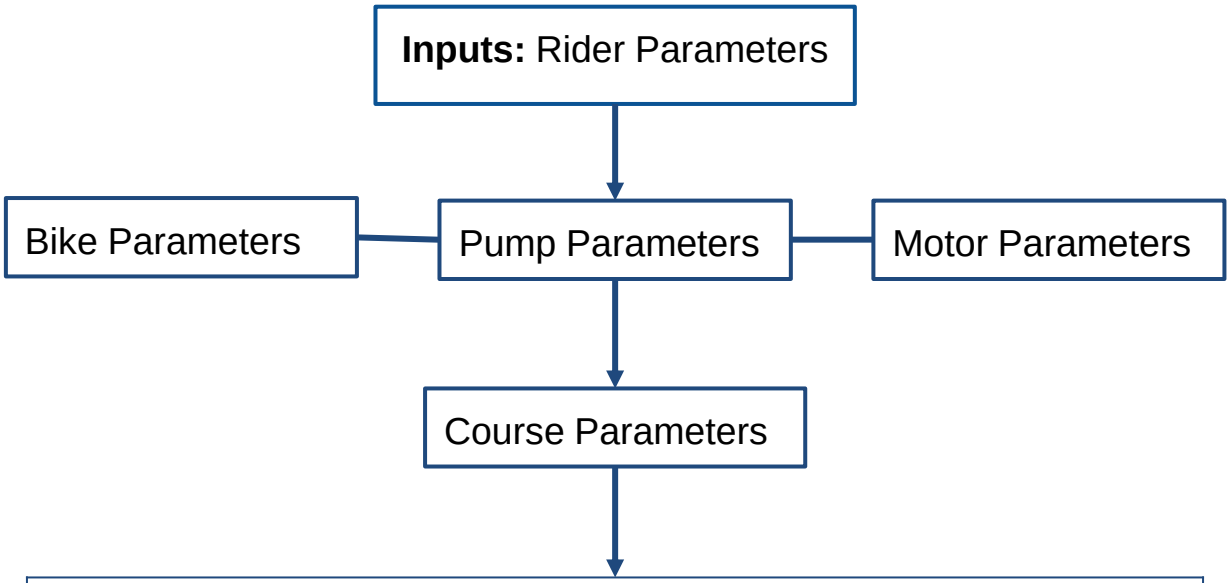
- Schlumpf Drive
- Rim Brakes
- Standard Tires
- Chain Drive
- Steelhead Bladder Accumulator
- Parker F11-5 Motor / Pump



Changes to Hardware Decisions:

- Decided Against the Schlumpf Drive

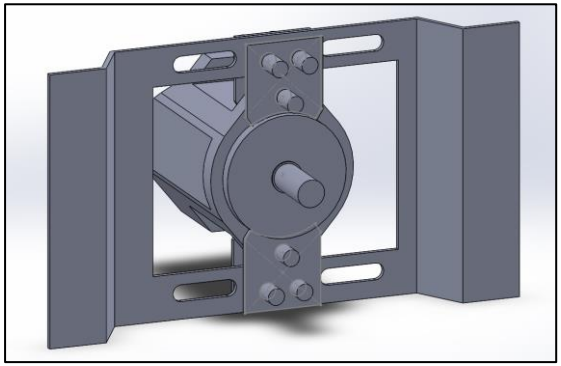
Calculations & Results



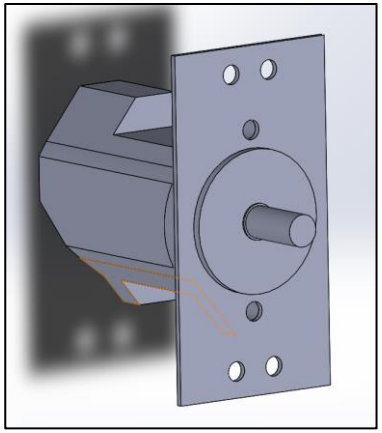
Predicted Race Results			
Sprint Race	600-ft	23.19	sec
Endurance Race	1 mile	204.21	sec
Efficiency Race	Testing is Required		%
Overall Gear Ratio (For Reference)	3.14		

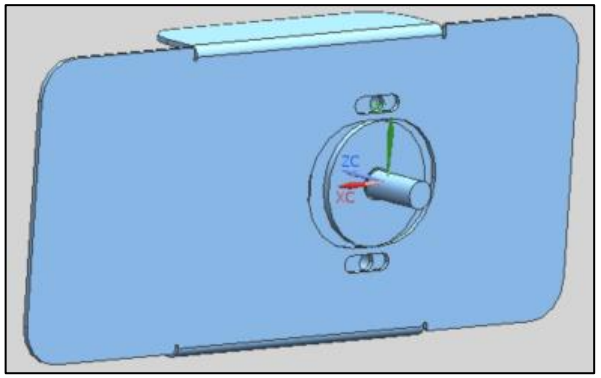
Vehicle Construction

Design Improvements

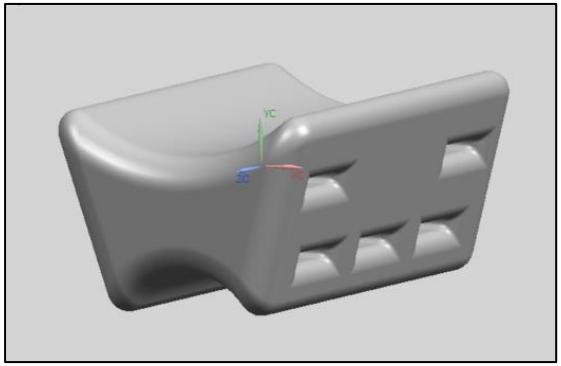


Initial Weld on Motor Mount

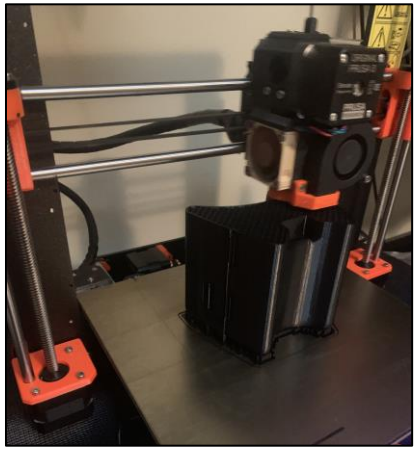




Final Bolt on Motor Mount



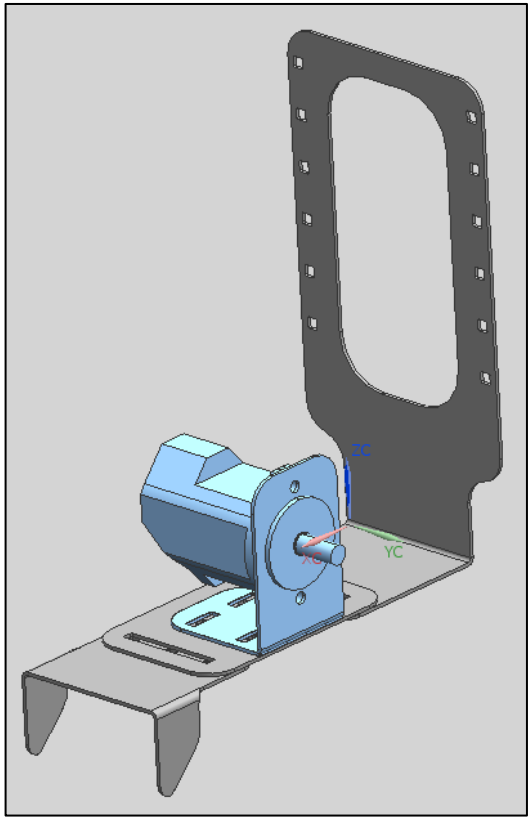
Accumulator Mount Design



Mounted Accumulator

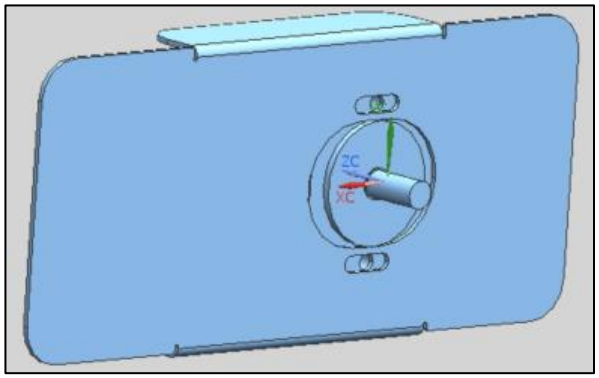
Mounting Plates

Rear Mounting Plate



Mounting Plates

Front Mounting Plate



Progress Towards Final Vehicle

Completed Tasks

Our Final adjustments:

- Mounting plates manufactured and attached
- Components mounted to plates
- Valves hosed

Next Steps...

- 3D print chain guard
- Develop the physical electronic circuit
- Test current design
  - Comfort and practicality of component placement
  - Effectiveness of circuit design
- Make changes to vehicle based on testing
- Improve upon our calculation and prediction methods

Lessons Learned

- Fundamentals of hydraulics
- Iterative design process
- Meeting design requirements
- Time management
- Working with a team
- Financial considerations

Conclusion

Special Thanks to:

- **NFPA**
- **Steve Gluck - Team Mentor**
- **Dr. Scott Sawyer - Team Advisor**

Thank You to Our Sponsors!

NFPA Fluid Power Vehicle Challenge

MTD For A Growing World.

TRIAD TECHNOLOGIES

Parker

EATON

BIRIA

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BLIMP CITY BIKE & HIKE
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Questions?