NFPA Fluid Power VEHICLE Challenge

NFPA Education and Technology Foundation

FINAL PRESENTATION
Western Michigan University
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Agenda

- Team Introduction
- Problem Statement
- Midway Review Summary
- Vehicle Construction
- Vehicle Testing
- Lessons Learned

Problem Statement

- To innovate, in an unlikely way
- Create breakthroughs that would otherwise go unsought
- Yield new understandings of how fluid power interacts with human power

Team Introduction

- Corey Smith: Senior EDT
- Cameron Tschupp: Senior EDT

Corey

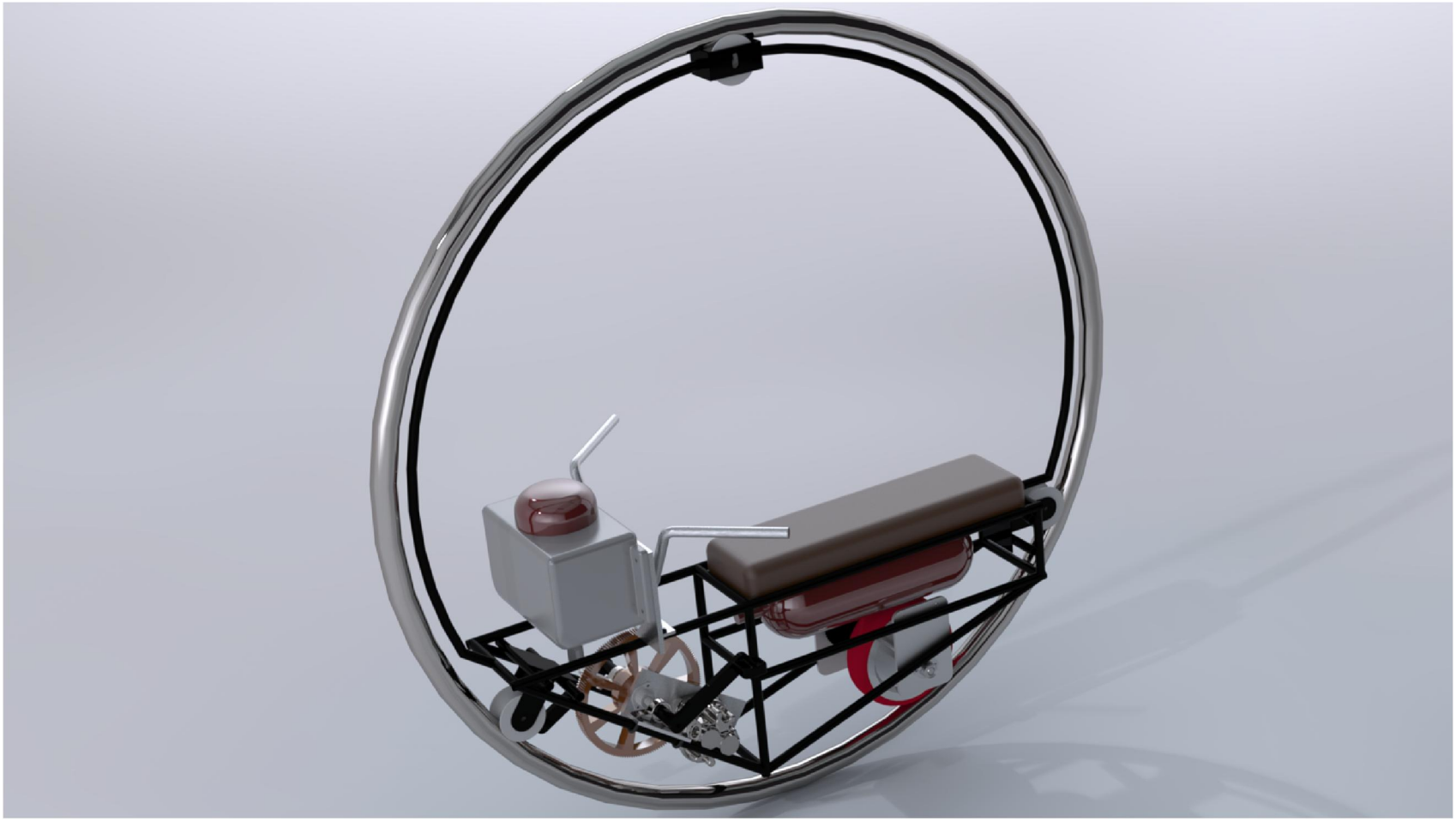
Cameron

Design Objectives

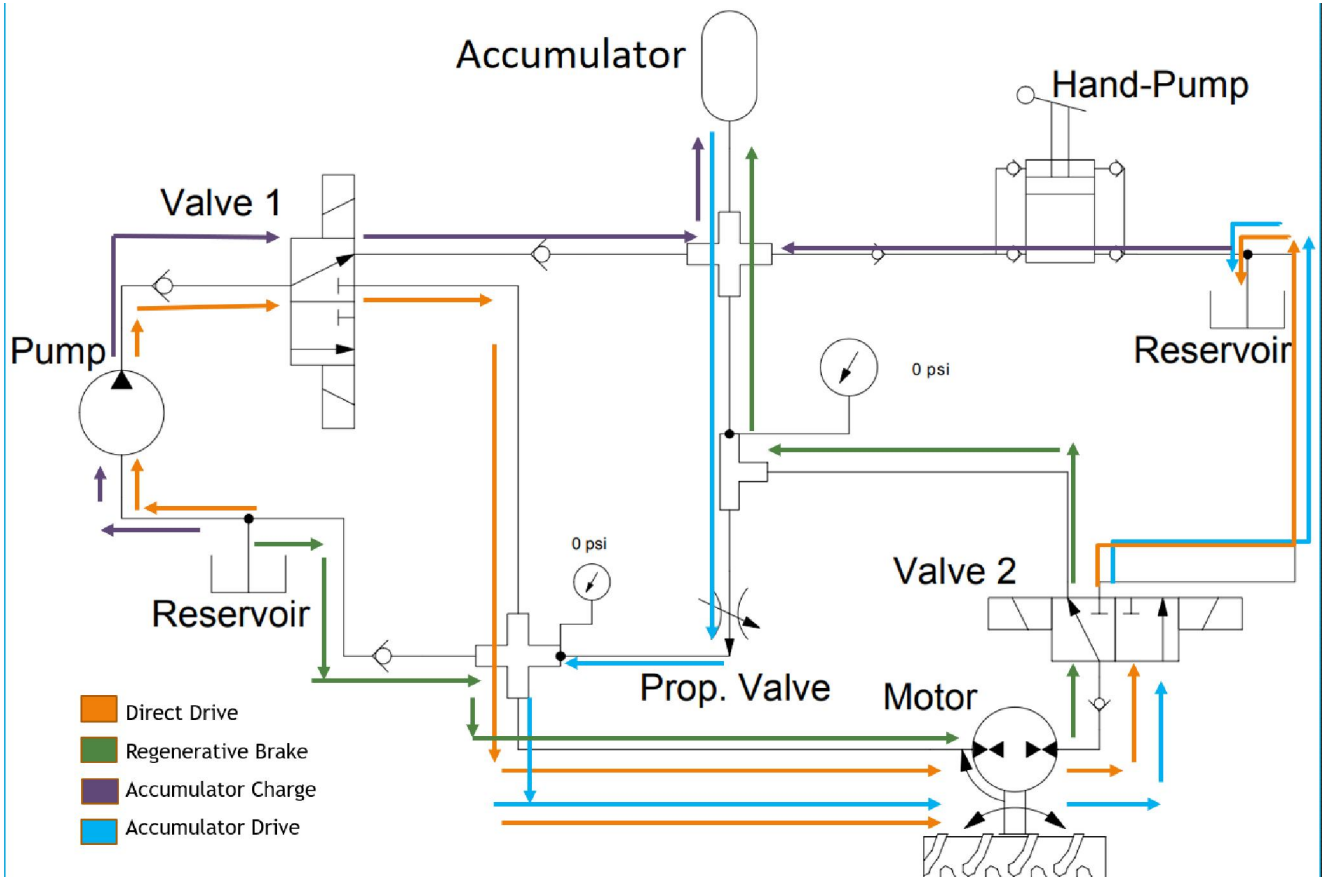
- Something unique
- Something made by us

Type	Space for hydraulic system	Aesthetic Design	Weight	Comfort	Steering	Stability	Rough Cost	Total
	2	3	1	1	1	1	1	
Recumbent	3	3	4	6	3	6	2	36
2 wheel	2	2	4	2	6	4	6	32
3 wheel	5	1	3	3	4	6	4	33
Handcar	6	3	2	4	1	6	5	39
Monowheel	4	6	3	4	4	3	2	42

Vehicle Design



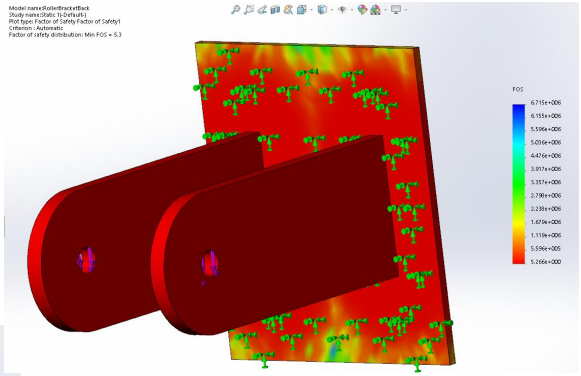
Hydraulic Circuit



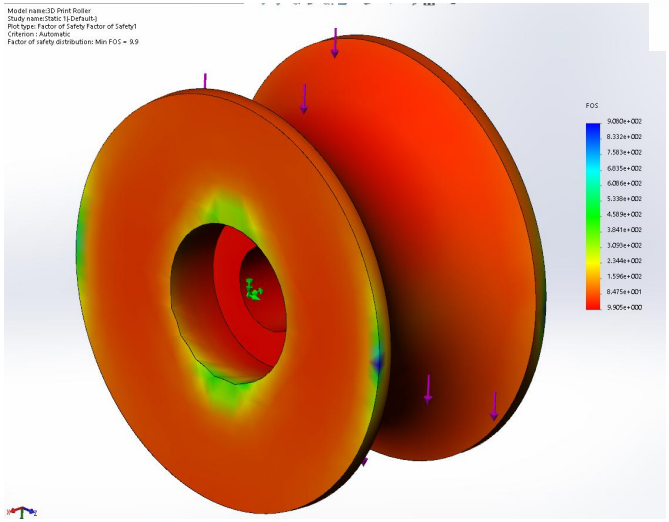
Component Selection

- Biggest pump and smallest motor
  - To achieve a gear ratio
- Different sized accumulator for testing purposes
- Manual switches

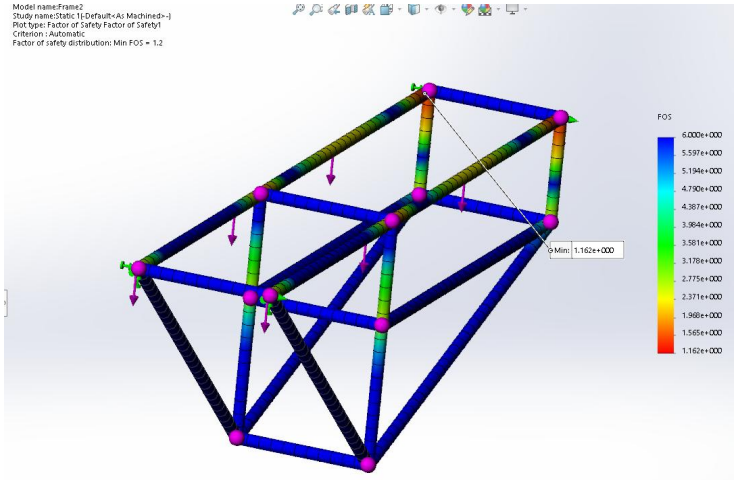
Analysis



Brackets FOS 5.3



Rollers FOS 9.9



Frame: aerospace-level FOS

Monowheel Construction

Inner frame cut and welded
Constructed tool to make rollers

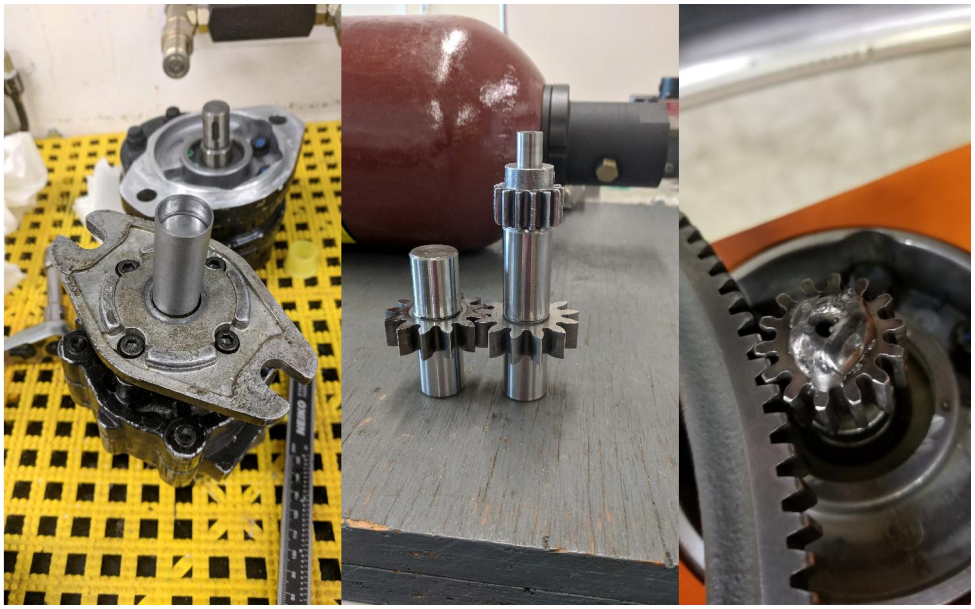
Gravity-Assisted Testing

Braking Things

- Hydraulic Disc brake on drive shaft
  - Keeps stopped under full accumulator pressure
- Caliper style brake on outer wheel
  - Allows for slowing down without loss of control
- Color-coded

Fluid Power Testing

- Motor received not functioning properly
- Replacement motor smaller shaft and SAE AA
  -Adaptor had to be made for gear
- Pump shaft too large for a gear for desired ratio in space allowed
- Set screws provided insufficient grip on pump shaft



Accumulators Testing

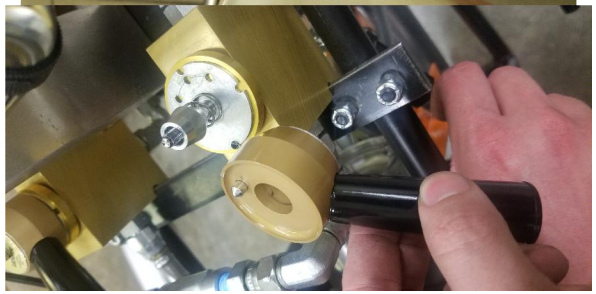
- Small accumulator
  - Fun, but could be better
- Large accumulator
  - Bladder didn't hold pressure
- Similar large accumulator
  - also didn't hold pressure
- Aerospace accumulator
  - works (and looks cool)

Usability Modifications

- Training wheels
- Handlebar grips
- Keyed 5/8ths to Pedal adaptor
- Padded seat

Breaking Things

- Motor Bracket
  - Replaced multiple times due to redesign
- Handlebar Failure
  - Stepped to grade 8 and larger
- Switch falling apart



Lessons Learned

- Practical knowledge in the function and application of fluid power
- CAD implementation into physical projects
- Greater understanding of effective power transmission
- Fabrication skills such as welding, milling, turning and assembly

Questions?