

N F P A

# ***Fluid Power***

## **VEHICLE**

# ***Challenge***



NFPA  
Education and  
Technology  
Foundation

Final Presentation & Design Review  
Michigan Technological University  
David Wanless  
April 10, 2025



# Michigan Tech Team



## Front Row (Left to Right):

Nathan Jewell, Paige  
Berry, Patrick Kline

## Back Row (Left to Right):

Ross Johanningsmeier,  
Dave Wanless, Logan  
Pokorski





# Final Vehicle Design Comparison



Last year's design



This year's design

Construction of our bike was completed by 03/26

# Continuous Design Improvement



- Pedal design
  - Remade
    - Steel vs Aluminum
    - Re-enforced
    - Reworked geometry to allow for full stroke
- Limit Switches
  - Solenoid activation
    - DC-DC Step Down Buck Converters
    - Heat sinks
    - 3D Printed wiring housing
    - Overall wire management
- Accumulator
  - larger accumulator for more volume
  - more pressure to increase speed
  - installed upright to optimize volume
- Pulley
  - Increased pulley reduce gear ratio
  - properly sized belt



# Pulley Ratio Adjustments



Original gear reduction with belt

- Displacement =  $0.758 \text{ in}^3/\text{Rev}$
- 22:1 gear reduction with belt

$$= (0.758 \text{ in}^3/\text{Rev}) \times (22/1)$$

$$= 16.676 \text{ in}^3$$

Current gear reduction with belt

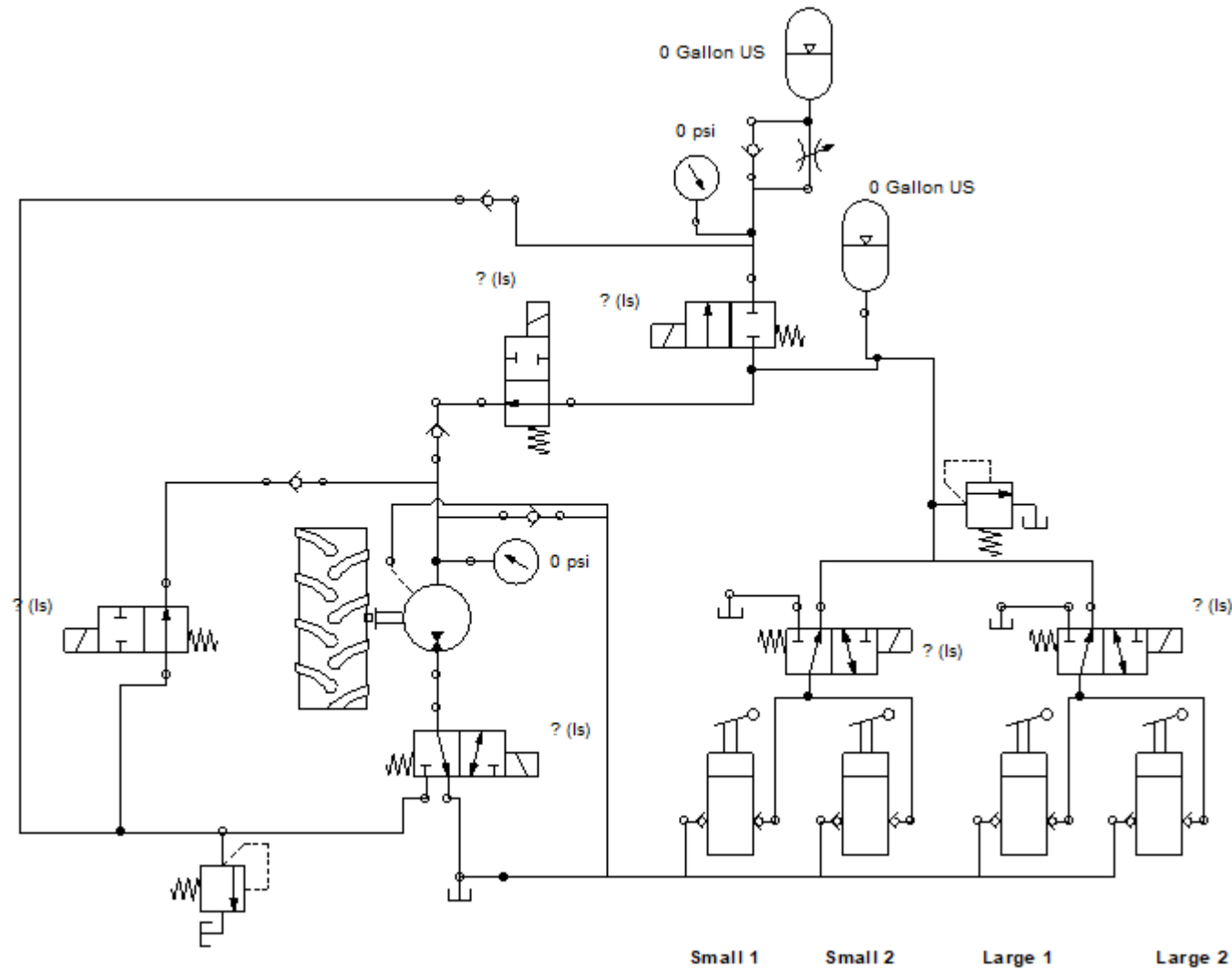
- Displacement =  $0.758 \text{ in}^3/\text{Rev}$
- 22:5 gear reduction with belt

$$= (0.758 \text{ in}^3/\text{Rev}) \times (22/5)$$

$$= 3.3352 \text{ in}^3$$



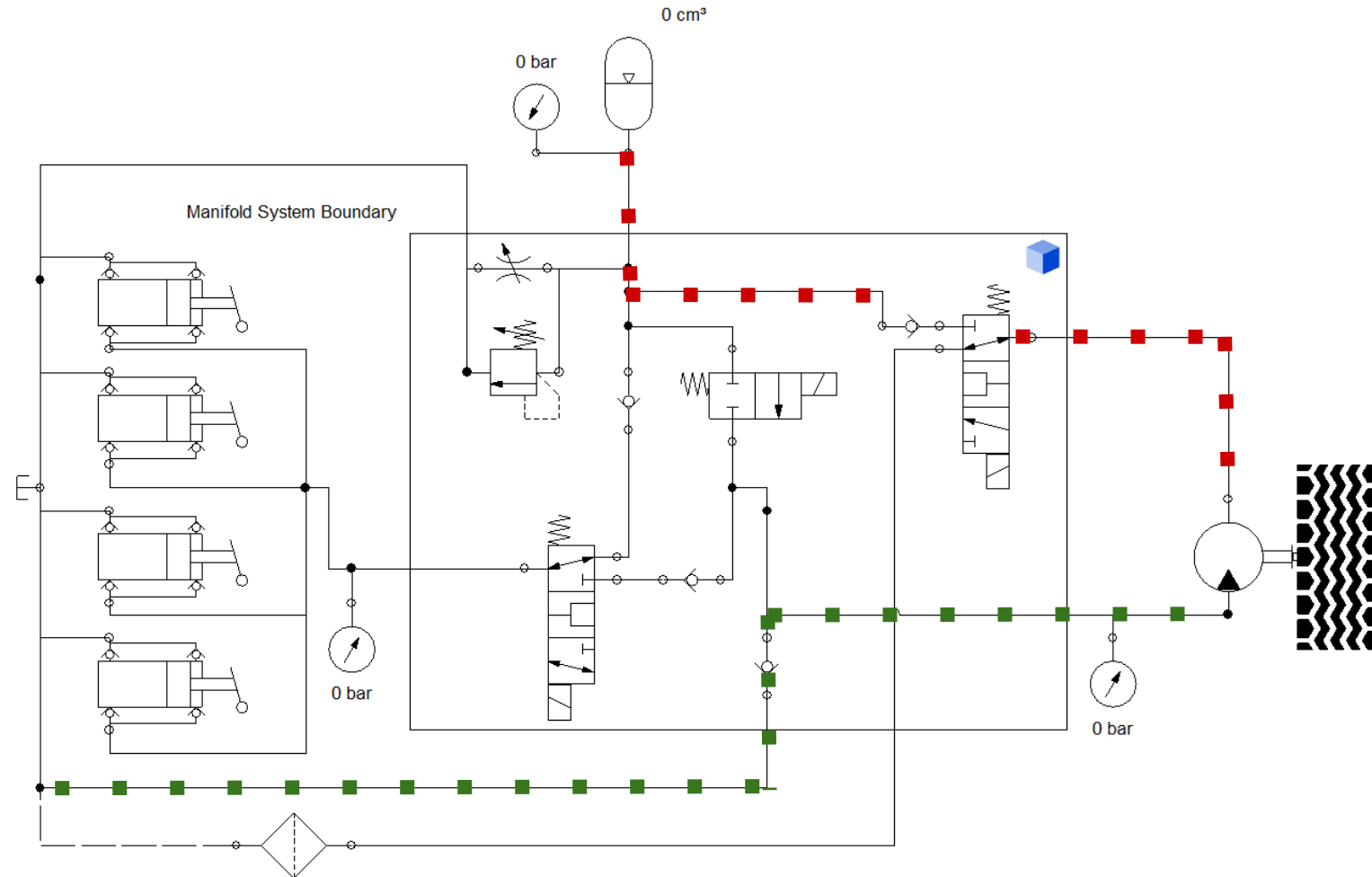
# Previous Team's Circuit



# Regen braking circuit

Regenerative circuit:

- wheel continues to spin which spins the motor
- fluid is drawn by motor
- valve is switched



# Lessons learned

- Starting manufacturing sooner
  - Expect the unexpected
  - Put an additional focus on pneumatics
- Effective communication
  - delegate tasks and communicate progress
- Needed effectively sized components
  - small ports on cylinders
  - small ports on 90s on the cylinders



# Huge thank you to the following:

- Josh Scarbrough (IFP)
- Ernie Parker
- Joe Jackan (JARP)
- Jony Ramos (Ross Controls)
- Dave Wanless
- MTU MET department
  - Scott Meneguzzo



# Questions?