

Abstract

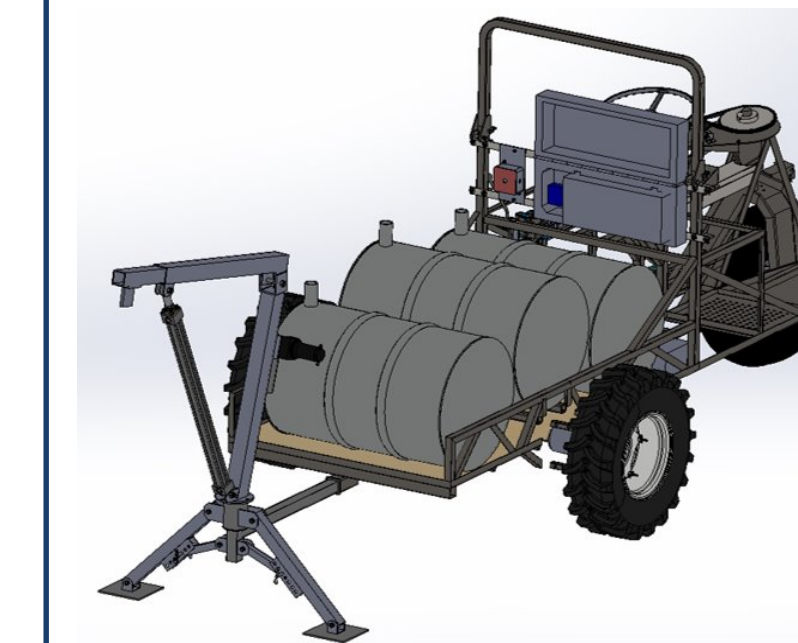
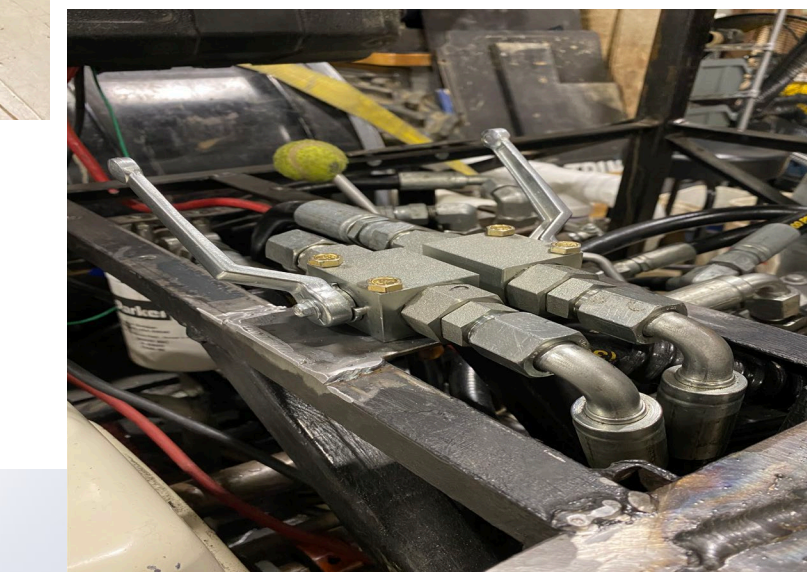
This project competes yearly in a contest located near Cincinnati, Ohio. The contest is inspired by the BUV company who strives to develop utility vehicles for third world countries. The contest aims to test the durability and performance of the BUV. The vehicle must be able to pump and carry water while maneuvering through difficult terrain. The previous team's innovative steering design was innovated to be removeable. The team created and implemented a zero-turn design. Two ball valves have been installed so that when in low gear, the fluid supplied to each of the rear drive motors can be restricted. A pivot point is created on each rear wheel and will increase maneuverability. Wiring issues associated with schematics and connections were corrected and a detachable crane design is being produced to fit on the back hitch of the vehicle.

Customer Needs and Requirements

- Customer Needs
 - Take first place in BUV competition
 - Handle rugged terrain, including knee deep mud
 - Transport three 55-gallon drums of water roughly weighing 1,400 pounds
 - Power Take off (PTO)
- Customer Requirements
 - Engine must not exceed 11 HP, unmodified
 - Pump water into 55-gallon drums
 - Decrease the force to turn by 10 lbs
 - Install 1 brake line per wheel
 - Replace Alternator to cut 3.7 lbs

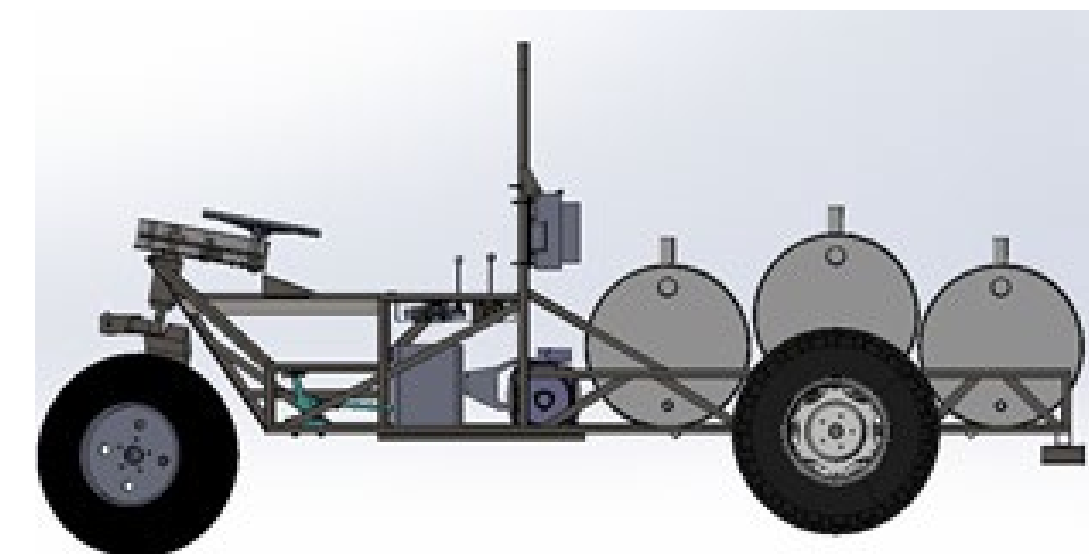
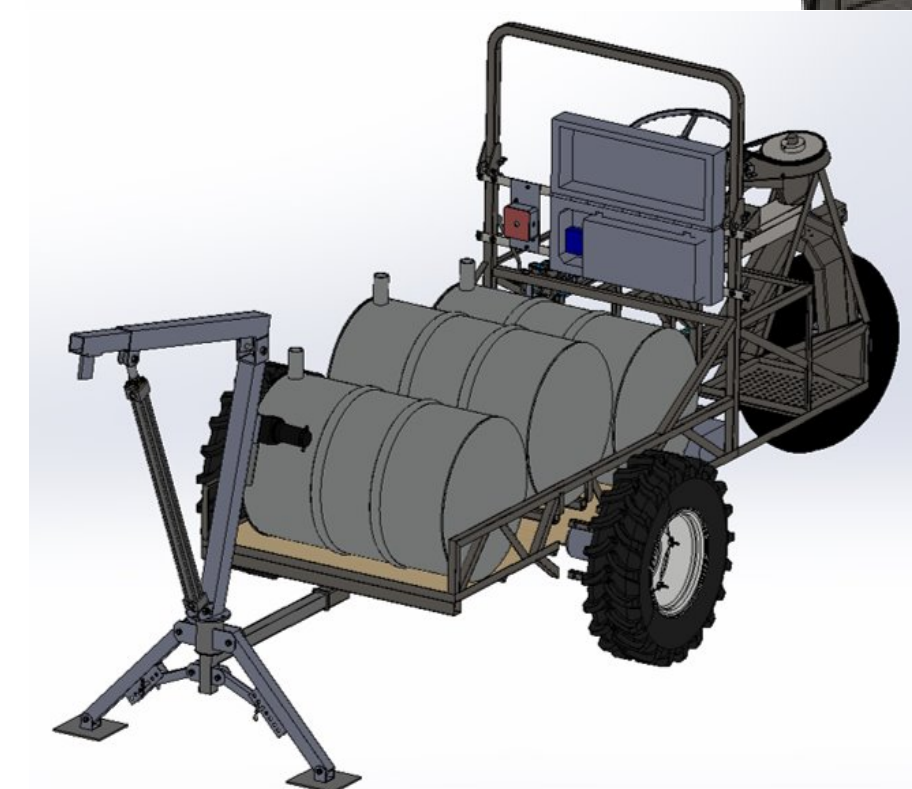
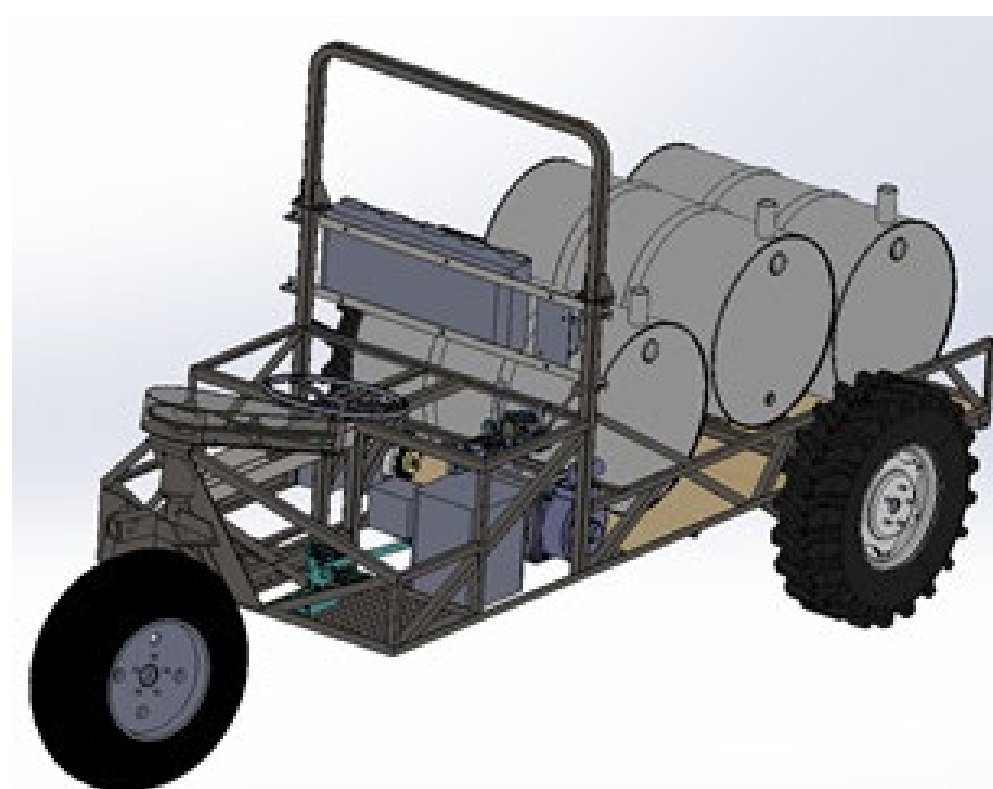
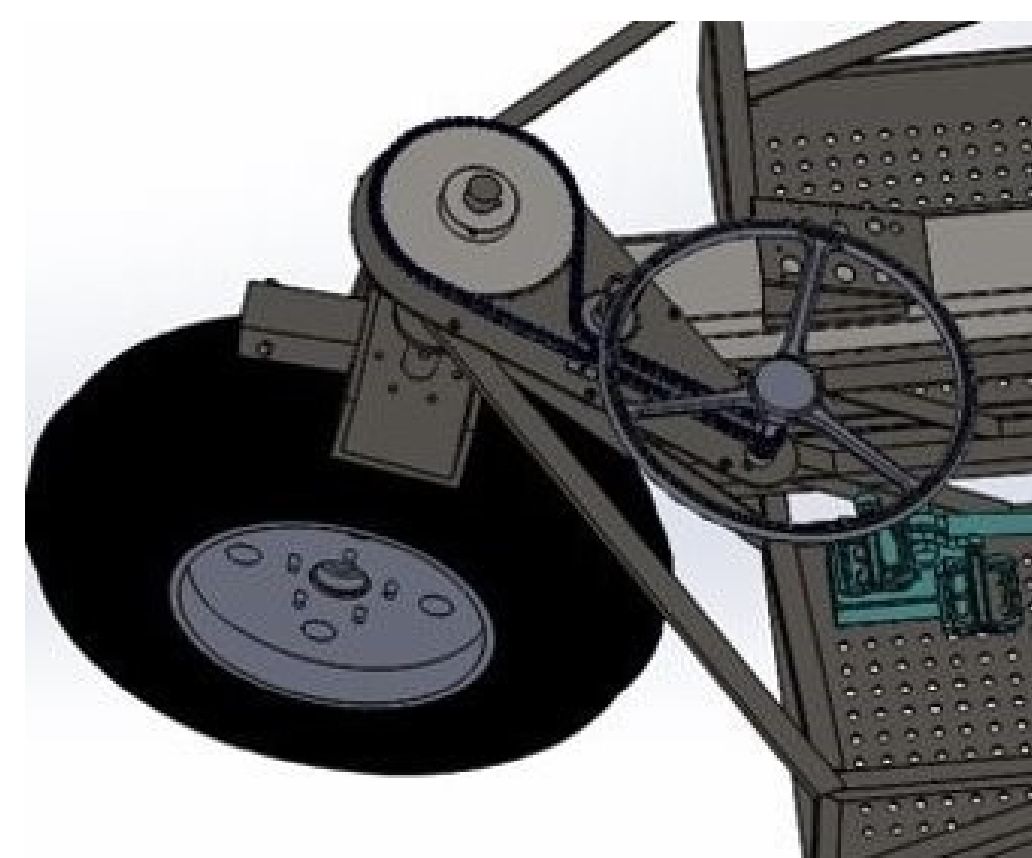


Concept Selection



- Removable steering
 - Chain-sprocket
- Drive Control
 - Zero-Turn Ball Valves
- Detachable Crane
 - Crane Mounting

Design Solution



Manufacturing

Chain-Sprocket Steering



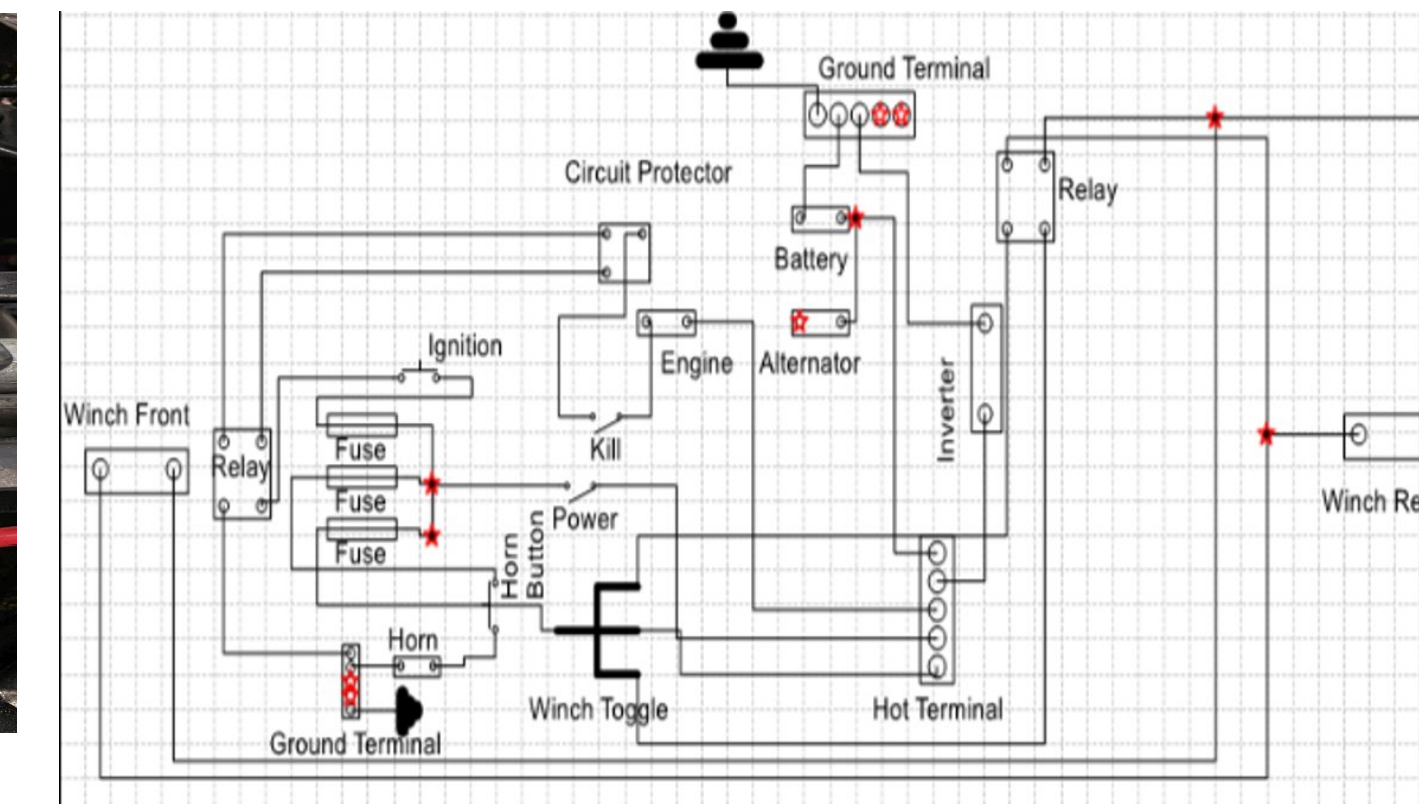
- Decreased force needed to turn
- Shroud cover created to protect operators from pinch points

Zero-Turn Concept Ball Valves



- Independent wheel power control
- Designed to enable coupling to the steering system

Wiring



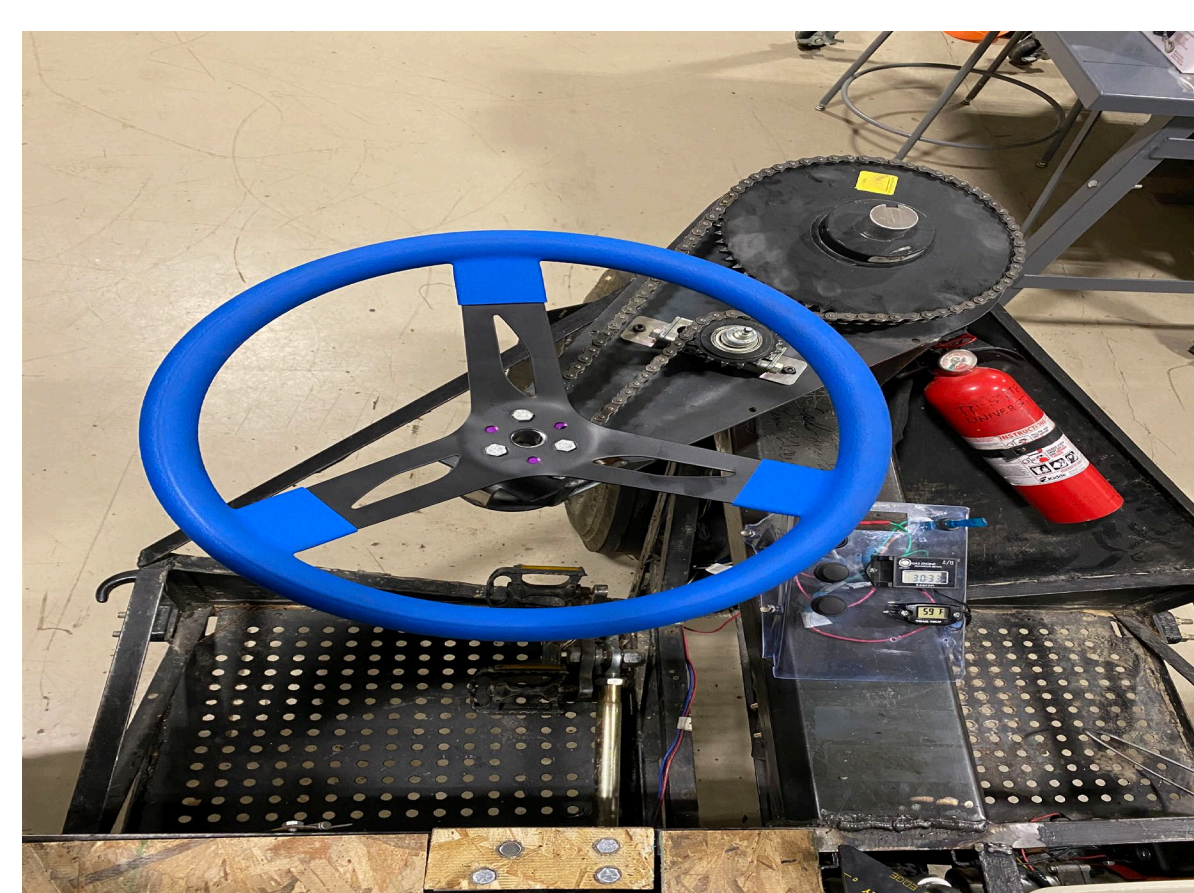
- Significant portions of the BUV were rewired to fix issues.
- A new, easier to read wiring schematic was created



Testing and Validation

Test 1: Steering Force

- Measured moment required to turn using a torque wrench
- Decreased force to turn by 9.7 lbs



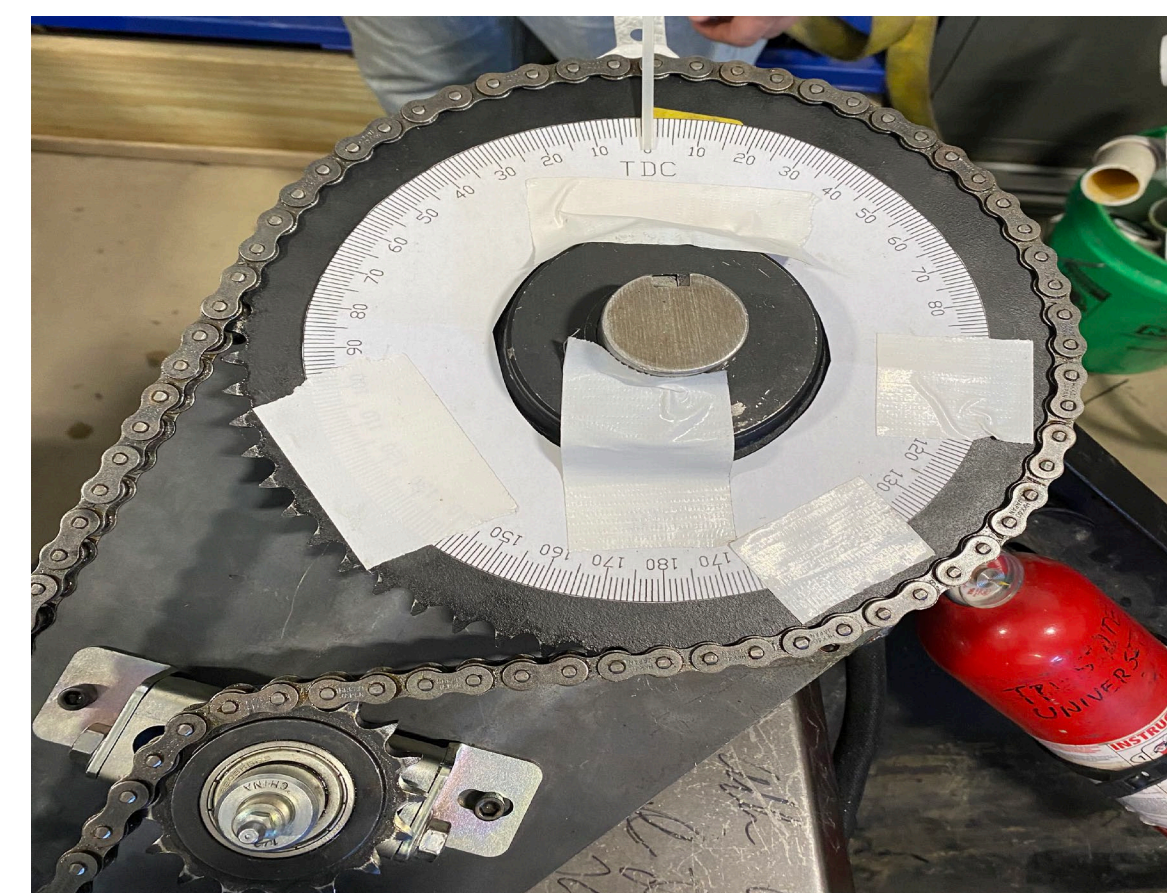
Test 2: Velocity vs Weight

- Derived equation for speed loss in relation to weight addition
- Max speed of fully loaded, and unloaded was 14 mph, 16.78 mph



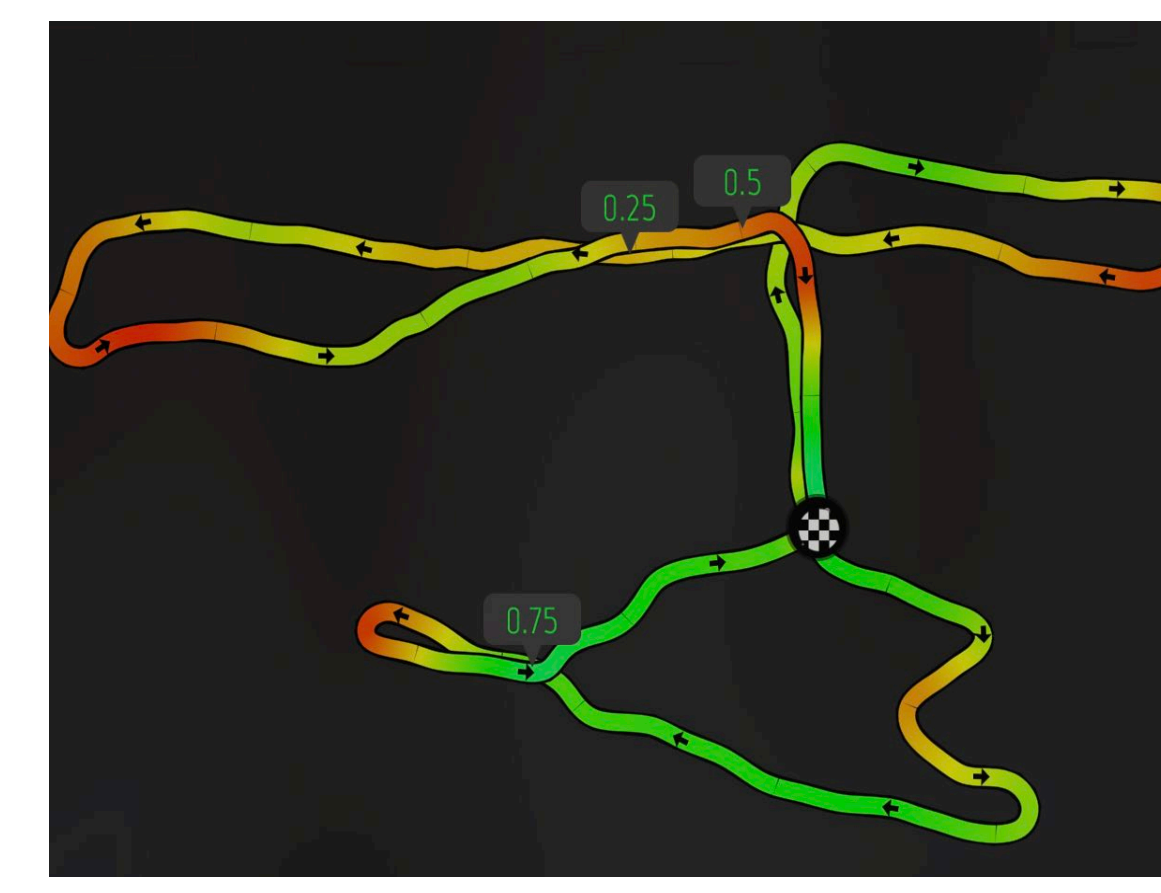
Test 3: Valve Actuation

- Measured wheel's independent angular velocity per 10 degree valve actuation
- Steering angle vs turn radius



Test 4: Fall Test Day

- Four hour long test
- Test course was 0.8 miles/lap
- Hydraulic fluid peaked at 118°F, well under max operating temperature



Acknowledgments

The BUV team would like to give a huge thanks to Mr. Joe Thompson II, Dr. Koch, Dr. Teichert and Dr. Chandrashekar for their analytical guidance and advice throughout the design and build process. The team would also like to thank SOS Hydraulics Inc for their practical design advice and efforts.

