

HPVC Midpoint Presentation

TEAM #21SPR06 – ASME HPVC

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Project Description



Figure 1 - Client - Perry Wood
(Machine Shop Faculty Manager)

1. Project based on ASME Human Powered Vehicle
 - Child Sized Recumbent Tricycle
2. Manufacturing and Integration mode
 - Finishing tacking and welding frame together
 - Begin Integration of major subsystems
 - Redesign Seat Clamp
 - Testing

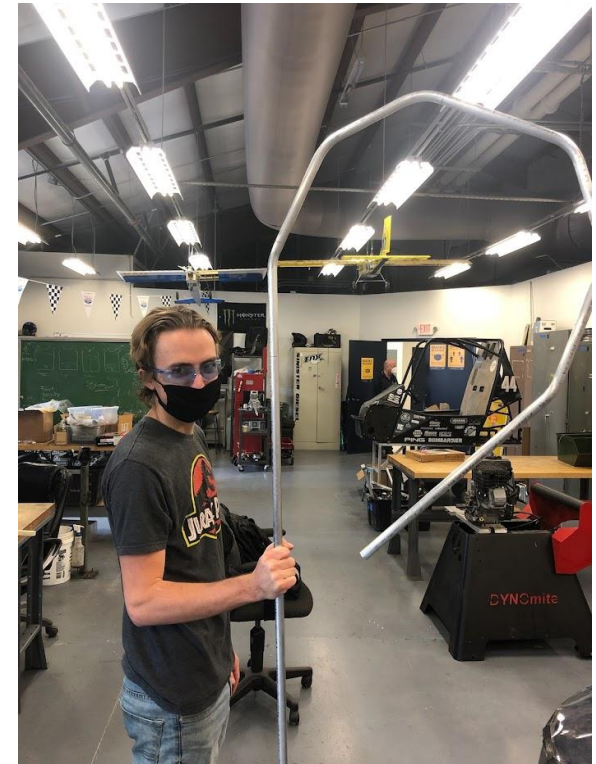


Figure 2 - Bent Roll Cage

Design Description

- 6-point roll cage (Redesigned)
- 6061 aluminum alloy
- Tadpole Tricycle (Rear Wheel Drive)
- Ackerman Steering
- Adjustable Seat Bracket (Redesigned)
- Three Wheel Caliper Braking
- Touch Responsive Display (Added)

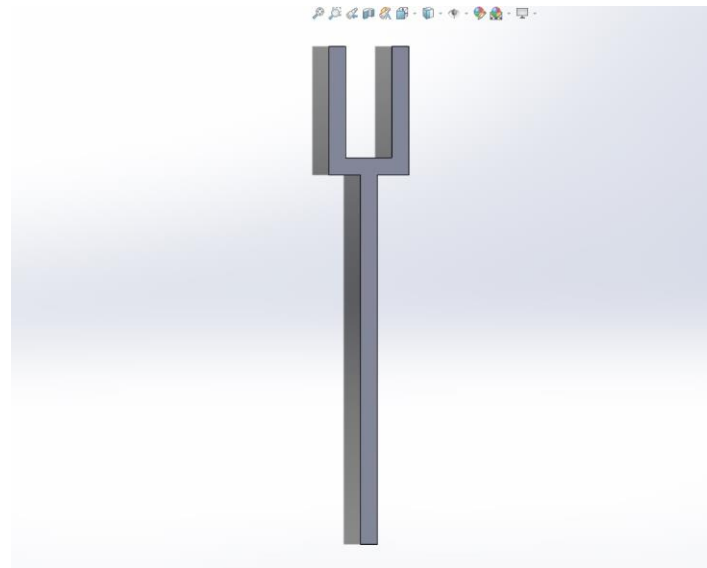


Figure 3- Redesign Rear Fork

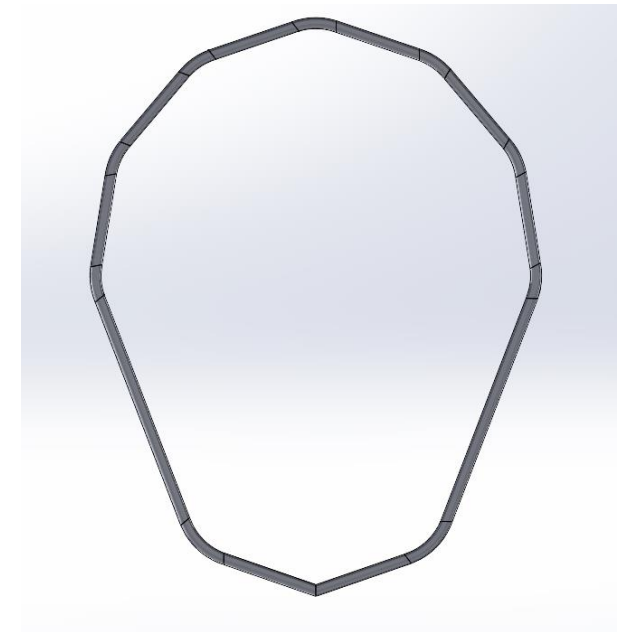


Figure 4 – Roll Cage CAD Model

Current State of System

Table 1: Current State of System

Completed Part	Equipment Used
Main Roll Cage loop	Pneumatic pipe bender, Vertical bandsaw
Rear fork and main frame section	Vertical mill, Horizontal bandsaw, Vertical bandsaw,
Front arms	Vertical mill
Team Member	Completed Task
Trent (Manufacturing)	TIG Welding, Cutting, Bending, Vertical Mill
Abel (Team Lead)	Vertical mill, Cutting, CAD
Martin (Software & Testing)	Arduino programming, website, CAD, testing plan
Preston (Purchasing)	Purchasing, Scheduling, Inventory

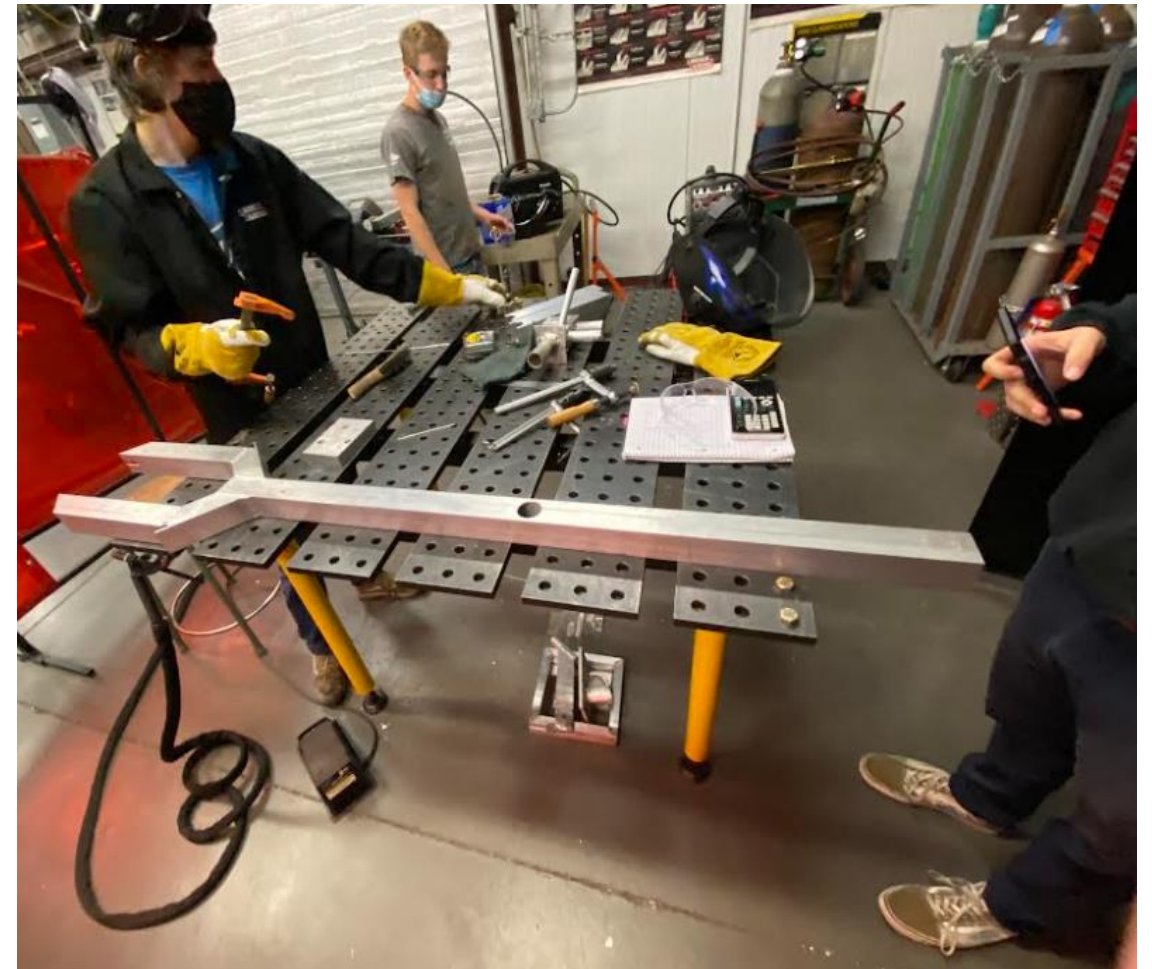


Figure 5 – Manufacturing

Current State of System

Table 2: State of ER's

Engineering Requirement	Status
Braking distance (within 8 meters)	Unmet
Cost under \$1600	On track to meet
Minimum of 3 wheels	Met
Highest gear ratio (3:1 or 4:1 typically)	Unmet
Seat-to-pedal distance (50 cm adjustability range)	Unmet
Turn radius (within 8 meters)	Theoretically met, Unproven
Tensile strength (250-560mpa)	Met (290mpa)
Footprint (Must fit in a 6.5' x 5.5' bed)	Met
Weight (no more than 45 kg)	On track to meet

Updated BOM

Current Budget Spent:

Table 3: Updated BOM

Purchased	Vendor	Item	Cost	Add. Cost	Total Costs	Totals
						\$1,600
9/3/2021	Mayorgas	2"x 2" Hollow Square	67.56		\$67.56	\$1,532
9/3/2021	Mayorgas	1.75" Round Tube	42.58		\$42.58	\$1,489.86
9/29/2021	OnlineMetals	1.5" Hollow Tube	44.10		\$44.10	\$1,445.76
9/29/2021	Amazon	Hall Effect Sensor	5.88	7.03	\$12.91	\$1,432.85
					\$167.15	\$1,432.85

Table 4: Expected Costs

To be Purchased	Cost	Add. Cost	Total Costs	Totals
6 Pieces Bike Brakes Calipers	22.99	10	\$32.99	\$1,399.86
Bike Disc Brake Kit, Aluminum Front and Rear Caliper	36.99	10	\$46.99	\$1,352.87
Seat	125	15	\$140.00	\$1,212.87
Wheels + Tires	100	10	\$110.00	\$1,102.87
Derailleur	100	10	\$110.00	\$992.87
Chain	50	10	\$60.00	\$932.87
Groupset (Rear Der, Trigger Shifter W Clamp, Crankset Dub)	375	10	\$385.00	\$547.87
			\$884.98	\$547.87

•Items to Reduce Budget:

- Various Chains
- Seatbelts/Harness
- Bolts/Screws/Nuts
- Wire (16AWG)
- Brake Levers
- Wheels/Rims
- Cranksets
- Cassette Gears
- Derailleurs

Task

Finish TIG Welding
Arms, Diagonal Sup

Measure, Cut, and
Supports

Redesign and Mach

Machine and Weld

Integration of rema



etal Layout

Implementation Plan

Table 6 – Future schedule for 486C

2021 HPV Capstone Schedule		
Date Due	Assignment	Team Members Involved
10/1/2021	Website Check 1	Martin
	Prep frame stock	Trent + Abel
10/8/2021	Implementation Memo	Martin + Preston
	Purchase Remaining Material	Preston
	Welding, bending, notching	Trent + Abel
10/12/2021	Midpoint Presentation	All
	Begin Integration of systems	All
10/27/2021	Individual Analytical	Individual
	Iteration and problem solving	All
	Testing	All + Martin
11/5/2021	Hardware Review 2 + Website 2	All + Martin
11/7/2021	UGrad Registration	Abel
	Testing	All + Volunteers
	Begin Final Poster and Report	Preston + All
12/8/2021	Final Cad Package and BOM	Abel + Trent + Preston
12/8/2021	Final Poster	All
	Final Product Meeting	All
	Operation/Assembly Manual	Trent + All
	Client Handoff	All



Figure 7 - Trent Welding Rear Fork



Figure 8 - Rear Fork and Frame

Testing Plan

Table 7 – List of Engineering Requirements

- **Brake distance:**
 - 2-3kph increments
 - Cone setup to signal brake actuation
 - Measure distance from cone to completed stop

- **3-Wheel Durability:**
 - Drop test
 - Intentionally drive off course
 - Tip over test

- **Seat Adjustability:**
 - Test drivers rate their seat comfort on a scale of 1-10, 10 being most comfortable

BRAKING DISTANCE (WITHIN 8 METERS)	COST UNDER \$1,600
MINIMUM OF 3 WHEELS	GEAR RATIO (3:1 or 4:1 typically seen in bicycles)
SEAT-TO-PEDAL DISTANCE (50 CM ADJUSTABILITY RANGE)	TURN RADIUS (within 8 meters)
VOLUME (TO FIT IN A 6.5' X 5.5' TRUCK BED)	TENSILE STRENGTH (250-560MPa)
Weight (no more than 45 kg)	

Testing Plan

■ **Cubic Volume:**

- Load into Trent's truck to ensure transportability

■ **Weight:**

- Weigh each segment of the frame throughout construction
- Combine with weights of other parts

■ **Budget-Friendly:**

- Continue recycling parts from past HPVs
- Team is already under budget for parts

■ **Gear Ratio:**

- Lowest gear to propel test driver without exhaustion
- Test drivers rate their power input from 1-10, 10 being not able to start propulsion

■ **Turn Radius:**

- Maneuverability course with radius of 8 meters

■ **Tensile Strength:**

- Load tests to validate calculations done in ME 476C
- Concentrated loads along central beam
- Strain gauge testing

Testing Plan – Equipment Required

- **Brake distance:**

- Orange cones – Campus Rec Services
- 30' measuring tape – Trent Todd

- **3-Wheel Durability:**

- Air tire pump – Trent Todd

- **Seat Adjustability:**

- Short people – Team friends/volunteers

- **Cubic Volume:**

- Truck – Trent Todd

- **Budget-Friendly:**

- Recycled old parts from past projects – Machine Shop

- **Gear Ratio:**

- Test drivers – Team friends/volunteers

- **Turn Radius:**

- Orange cones – Campus Rec Services

- **Tensile Strength:**

- Completed HPV frame – Team
- Strain gauge – Dr. Wade

- **Weight:**

- Scale – SAE Baja Team

Questions?
