MIDPOINT PRESENTATION HPVC 2020

Team Members:

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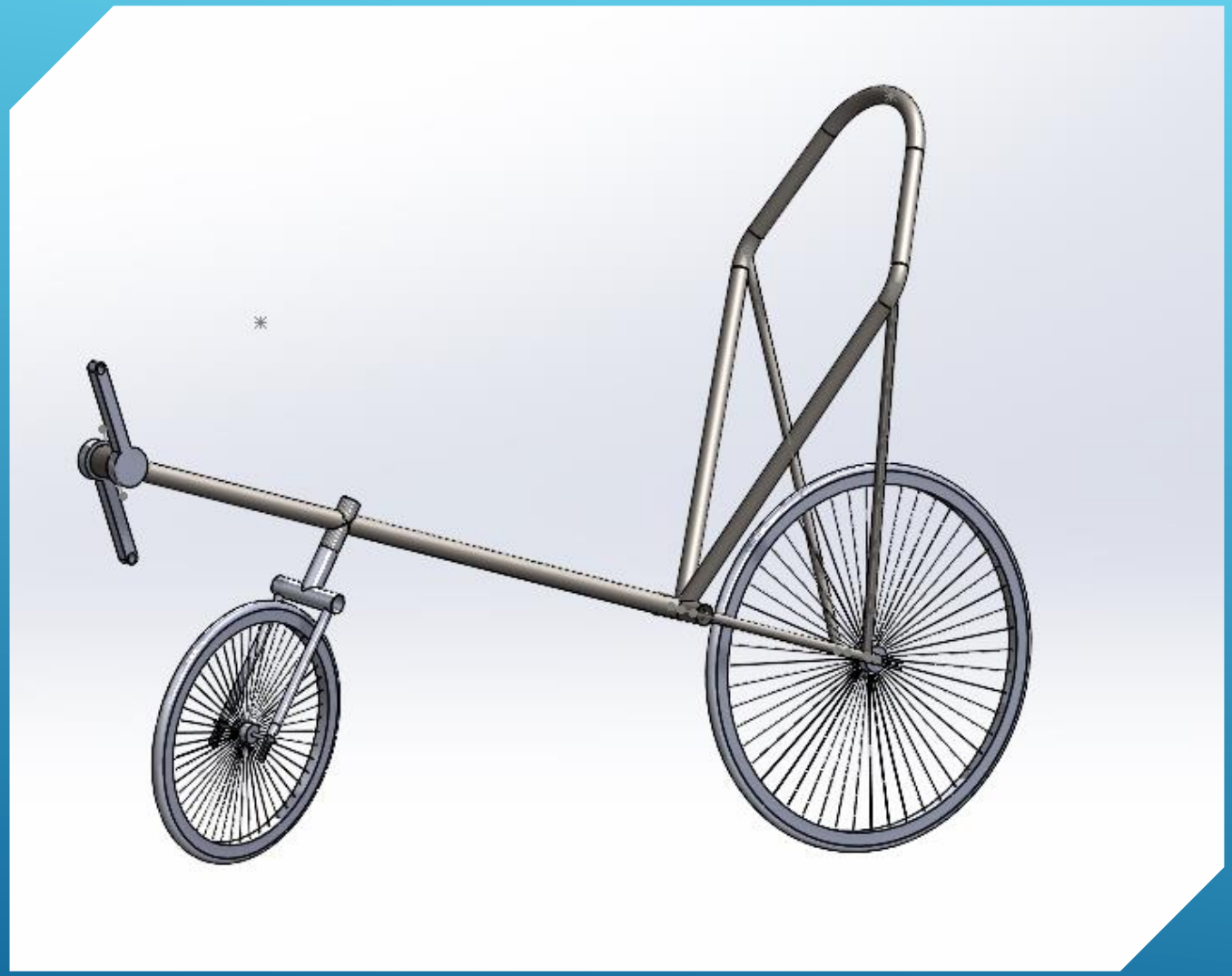
PROJECT DESCRIPTION

- Team Client: Perry Wood
- Team Sponsors: NAU ASME, Absolute Bikes, Copper State Bolt and Nut
- Objective: Students use sound engineering principles to create a sustainable, innovative and safe vehicle.
- Problem Solved: Bringing human powered transportation to underdeveloped or inaccessible parts of the world while also creating a more sustainable mode of transportation.
- Changes Made: E-Fest has been announced as digital, team is currently focusing on building the main parts of the vehicle with analysis on innovative parts.

DESIGN DESCRIPTION



- Two-Wheel recumbent design
- Minimize materials required
- Streamlined and simple
- Interchangeable components

Figure 1: Two-wheel recumbent design

CURRENT STATE OF THE SYSTEM: ENGINEERING REQUIREMENTS

Table 1: List of Engineering requirements

Engineering Requirement	Target Value	Progress
Weight	< 50 pounds	Under weight
Frame Strength	2 < Yield FOS < 4	1.5 – Material Mix Up*
Turning Radius	≤ 15 feet +0, -3ft	Not tested yet
Top Speed	> 45 mph	Not tested yet
Drag Coefficient	CD < 0.2 +/-.1	Wind Tunnel Testing
Innovation	Max points	Ongoing
Cost	< $3000	Under budget
Mount/Dismount Time	< 30 seconds +/- 5 s	Not tested yet
Frontal Area	≤ 5 square feet	On going
Ergonomics	Comfort for 2 hours +/- 15 mins	Not tested yet

CURRENT STATE OF THE SYSTEM: COMPLETED TASKS BREAKDOWN

Table 2: List of completed tasks

Completed Tasks	Teammate(s)	Completed Date
Purchase and Pick Up PVC	Ryan	8/25
Model PVC	Whole Team	9/18
Purchase and Pick Up Frame Material	Ryan, Sam	9/23
Acquired Fork	Paolo	9/25
Cut and Coped the Main Frame	Paolo, Ryan, Sebastian	9/25
Prepped the Main Frame to attach the Head Tube/Steering	Paolo, Ryan, Sebastian	9/25

Figure 2: Main Frame Joint

Figure 3 :Main Frame Overview

Table 3: Bill of materials

Description	Cost	Ordered/ Arrived
PVC Pipe and Fittings for MockUP	$65.40	Yes/ Yes
1.5" and 0.75" Tubing for Frame	$0 Donated	Yes/ Yes
Round Bar and Plate For Gear Train	$0 Donated	Yes/ Yes
4140 Steel and 6061 Aluminum Plates for Gear Train	$351.95	Yes/ Yes
4 Point Racing Harness	$114.68	Yes/ No
Misc Bike Parts (Front and rear wheels, brakes and brake components, rear sprockets, chain, shifting components, brake and shifting cables)	$528.67	Yes/ No
More Misc Bike Parts (Front sprockets and shifters, crank set and bearings, pedals)	Unknown	No/ No Ordering this week
Steering Headset	$0 Donated	Yes/ Yes
Fork	$0 Donated	Yes/ Yes
Handlebar	Unknown	No/ No Decide and order once shifting components arrive
Seat	Unknown	No/ No Decide and order once frame is complete
Fairing	Unknown	Waiting
Remaining Gear Train Components	Unknown	Waiting
Total Cost Thus Far	**$1060.70**	

IMPLEMENTATION PLAN

FRAME CONSTRUCTION
(PAOLO , RYAN, AND SEBASTIAN)

- The Tube will be notched and tack welded
- Then the tube will be bended for the roll cage , this will be welded to the main tube
- Final welding will be done after all the components are in place
- Sprockets and brakes will then be assembled

WHEELS, STEERING AND BRAKES (SAMANTHA, ALLISON, ANU AND PAOLO)

- The disc brakes will be attached along side the wheel inside the fork
- There will be hand brakes for front and rear wheel
- The braking cables will follow the frame and up the steering column into the hand brakes.

DRIVE TRAIN
(RYAN AND SAMANTHA)

- The sprockets set will be attached to the wheel assembly which will slide into and get bolted to the frame with the rear axle
- The front sprockets will be attached to the cranks
- Front and rear derailleur will be attached to the frame to allow shifting
- Chain will be cut to appropriate lengths and installed on the sprockets
- Finally adjust cables and derailleur for smooth shifting

SEAT, HARNESS
(SEBASTIAN, RYAN AND SAMANTHA)

- Weld a mounting to the frame to attach the seat
- Then attach the harness to the roll cage part of the frame

FAIRING (ANU, SEBASTIAN)

- Wind Tunnel tests for the fairing concepts

Table 4: Manufacturing Plan

Task	Materials used	Deadline to finish manufacturing and assembly	Main Persons Responsible
Frame Construction	1018 steel tubing	4-Oct	Paolo, Ryan, Sebastian
Finish Ordering rest of the material	Sockets, handle bar, seat,shifters, crank sets bearings	4-Oct	Team
Wheels	wheels in progress	7-Oct	Allison
Brakes	callipers, cables, levers (in prog)	7-Oct	Samantha, Allison
Wind tunnel testing	3D printed fairings	9-Oct	Anu and Sebastian
Steering	handlebars, head tube bearings, extender,	14-Oct	Samantha, Paolo and Anu
Drivetrain	front sprockets, chain, derailleurs, shifters	18-Oct	Samantha and Ryan
Harness	order harness	18-Oct	Ryan and Samatha
Seat	seat and mounting components	18-Oct	Sebastian
Functional/ Safetey testing		25-Oct	Team
Fully Functional HPV		1-Nov	Team

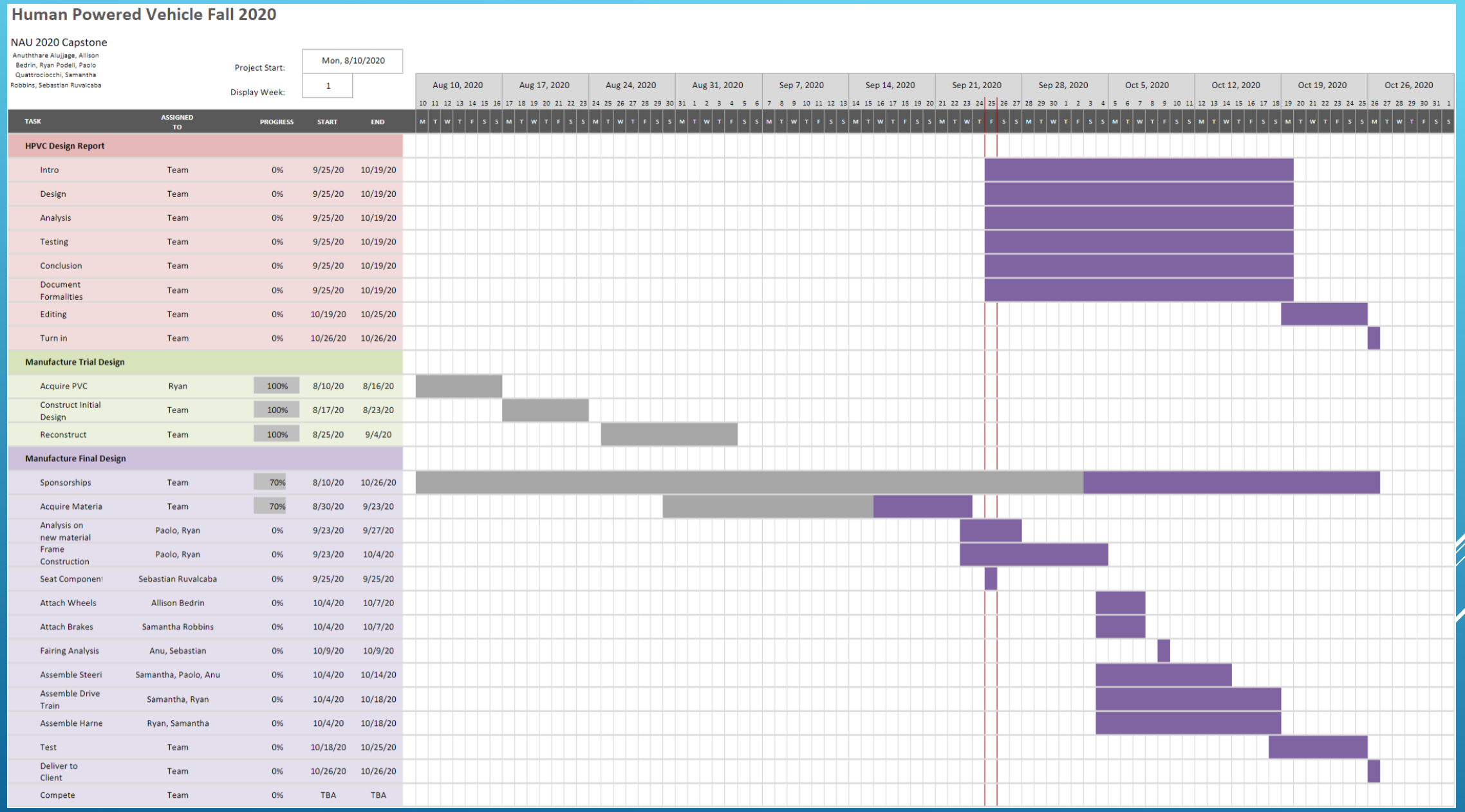


Figure 4: Ghantt chart

TESTING PLAN

3 Categories

Functionality

- Mount/Dismount Time
- Weight
- Turning Radius
- Top Speed
- Cost
- Innovation

Safety

- Frame Strength
- Ergonomics

Aerodynamic Design

- Drag Coefficient
- Frontal Area

TESTING PLAN

- Functionality Testing
  - The HPV will be ridden to ensure all components work as expected. Per competition requirements, the team will setup obstacles such as slalom and U-turn to test vehicle's capabilities.
- Safety Testing
  - Once frame and roll cage are built, tallest rider will be strapped into the vehicle and team will roll the HPV over and ensure rider doesn't touch the ground and cage remains sturdy.
- Wind Tunnel Testing
  - Fairing designs will undergo wind tunnel testing prior to construction.
  - Scaled down 3D printed fairing will be used at NAU fluids lab to measure drag forces on the designs.

Figure 5: Cone Slalom Obstacle

Figure 6: Roll Cage Rollover Safety Test

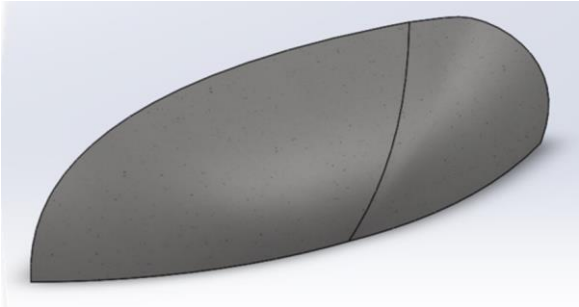


Figure 7: Fairing Concept 1

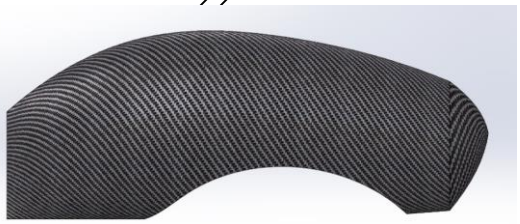


Figure 8: Fairing Concept 2

THANK YOU

- Any Questions?