



Beetle-Weight Combat Robot

Mechanical and Aerospace Engineering

Authors: Porter Galvan, Alex Gansert, Benton Knox, Jamie Le, and Mia Woods

Advisor: Dr. Rizacan Sarikaya and Joseph Thompson II

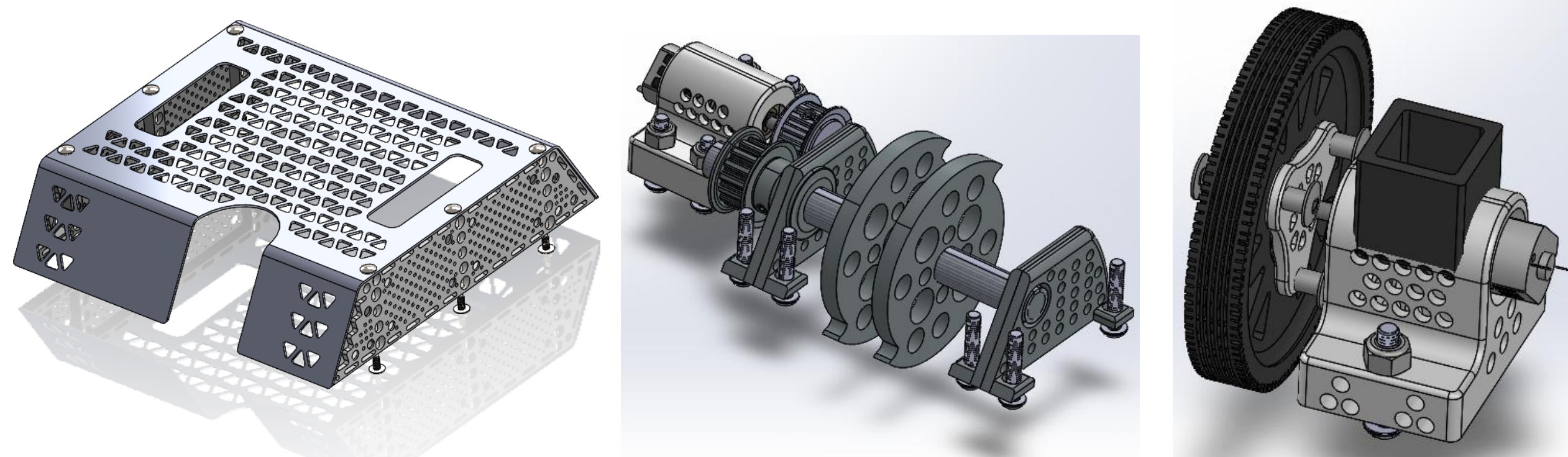
Abstract

The 2024-2025 Combat Robot team will be competing in the National Robotics Challenge (NRC) from April 4th-5th in Marion, Ohio. The team’s primary goal is to place in the top three for the Beetle Weight division, a category where the robot must remain under 3lbs. To achieve this, the team is designing and building a robot that adheres strictly to the NRC’s technical and safety guidelines, ensuring it is both functional and competitive. The project budget is initially \$700 plus any additional funding donated or fundraised by the team.

Customer Needs and Requirements

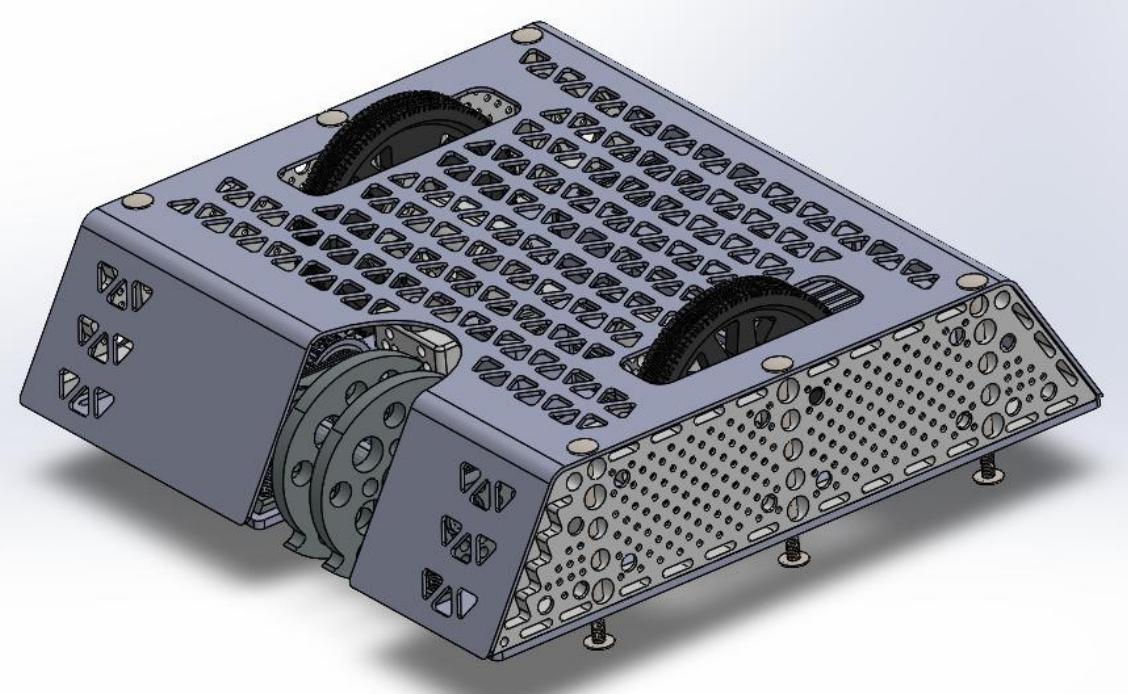
- Win National Robotics Challenge for Beetle-Weight Combat Robot
- Sizing: Under 3 lb. and smaller than 14” x 14” x 14”
- Low manufacturing cost and easily repairable
- Manual complete robot shutdown is under 60 seconds
- Manual disconnect and complete weapon system shutdown under 15 seconds
- Visible weapon locking devices and sheath
- Easily visible and controlled mobility
- Wireless control over at least two different approved radio frequencies
- Combat Simulation performed before competition

Concept Selection

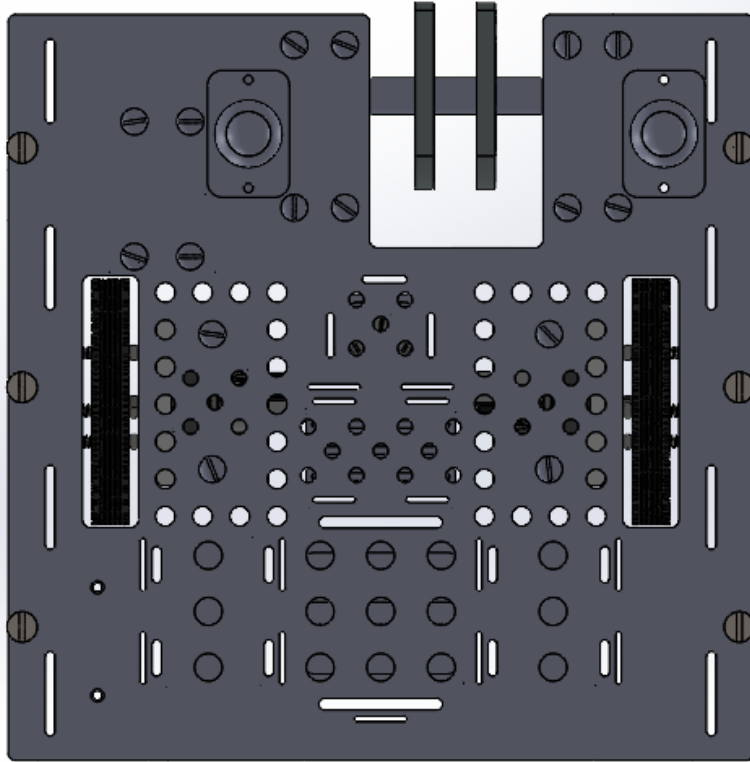


Frame	Weapon	Drivetrain
Trapezoidal prism	Drum Spinner	Two Wheel
UHMW PE & Polycarbonate	Harden D2 Tool Steel	TPU & ABS

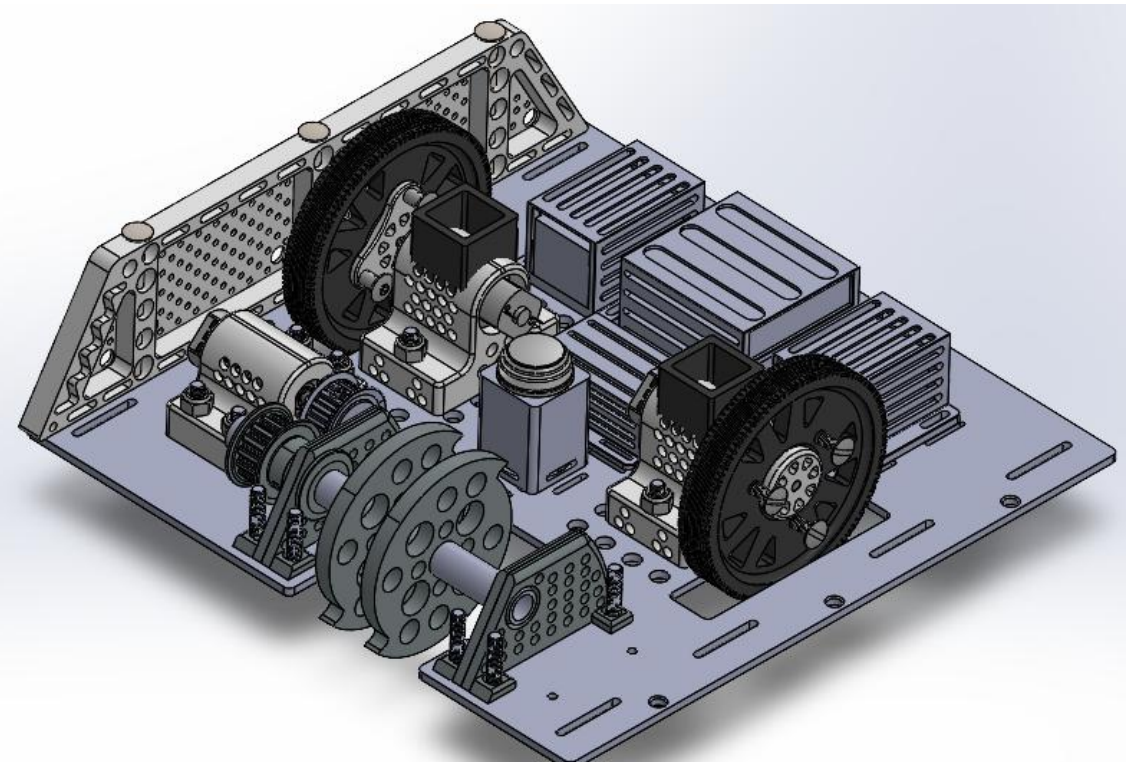
Design Solution



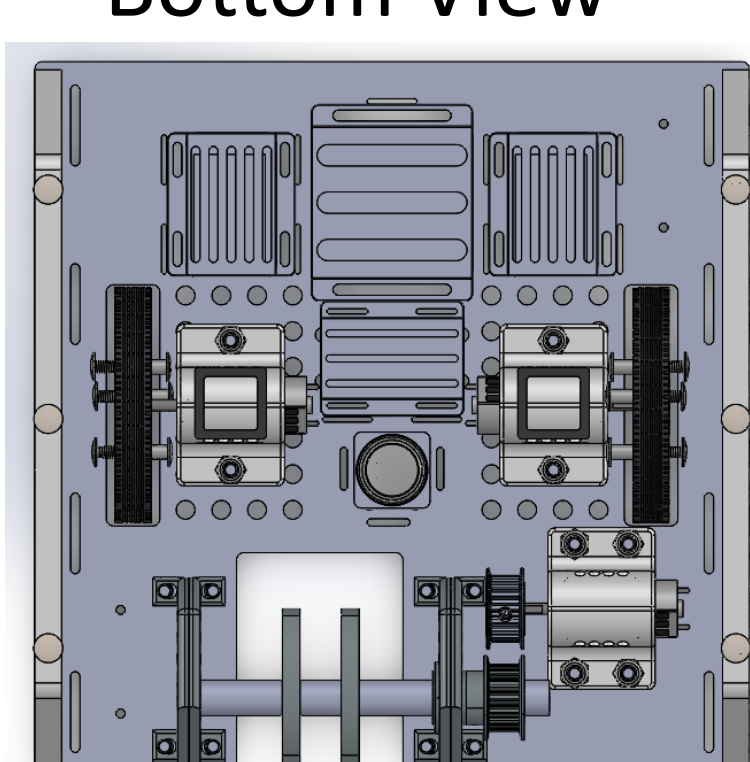
Isometric Top View



Bottom View



Isometric Internal View



Top Internal View

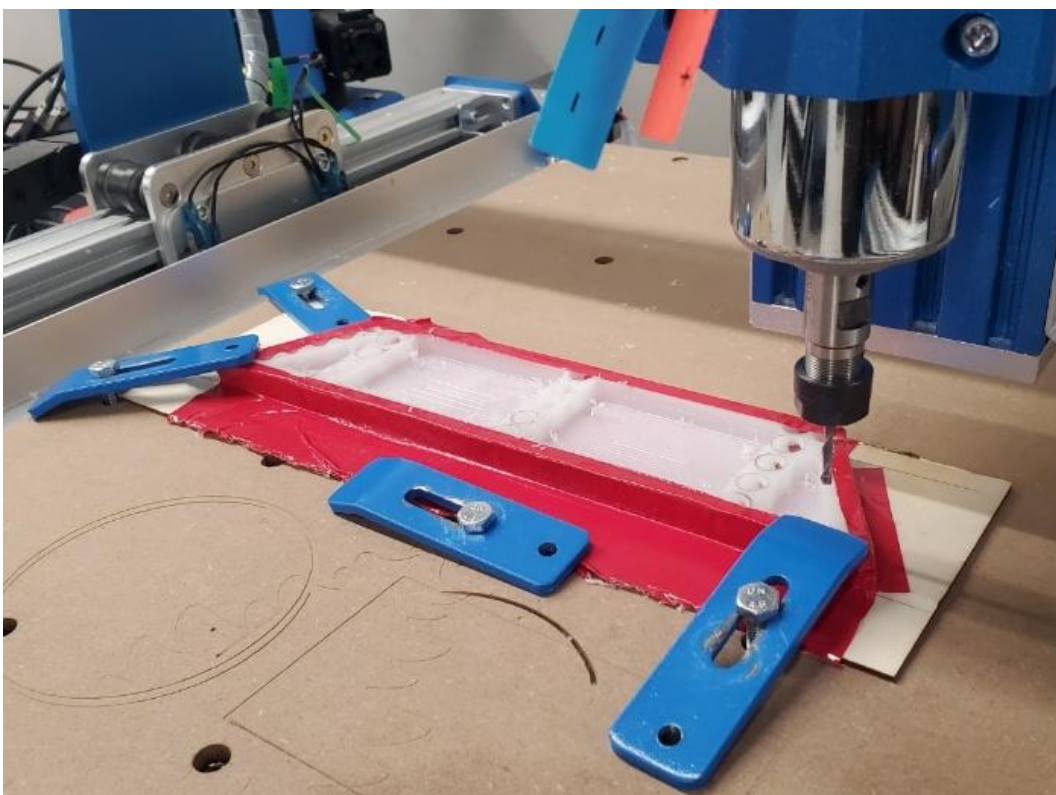
Manufacturing

Frame



The entire frame was cut on Water Jet Ex. Top Plate

Pockets cut out of side panels using CNC Router

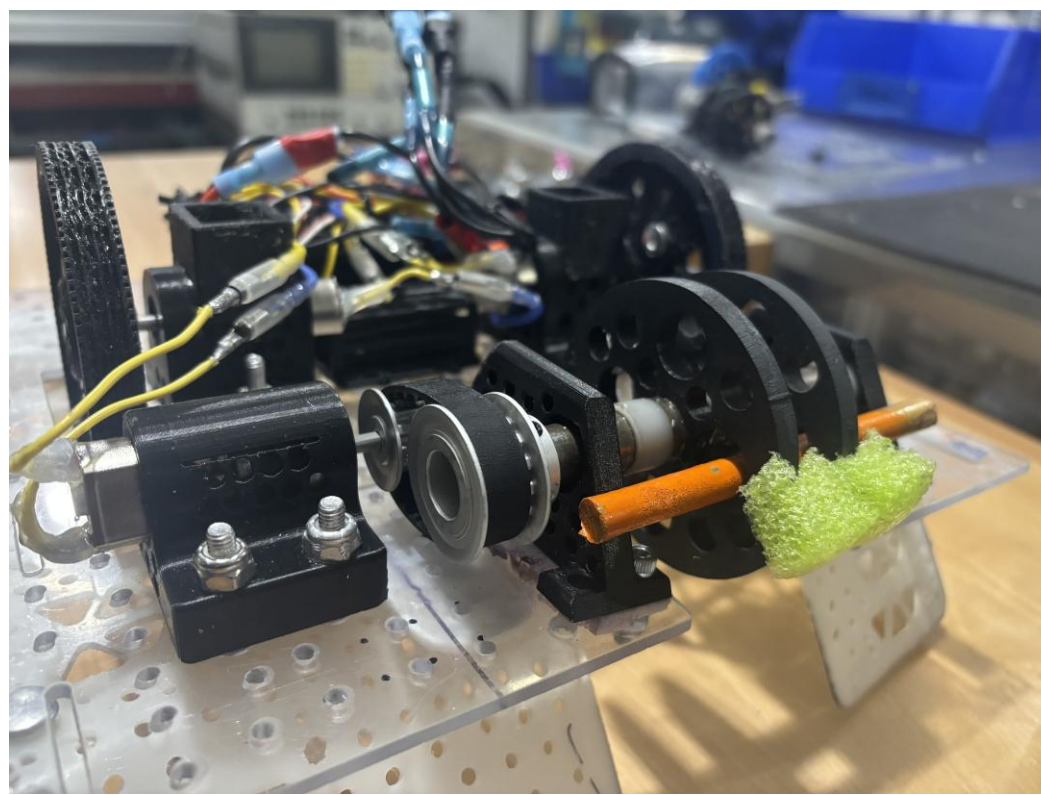


Weaponry

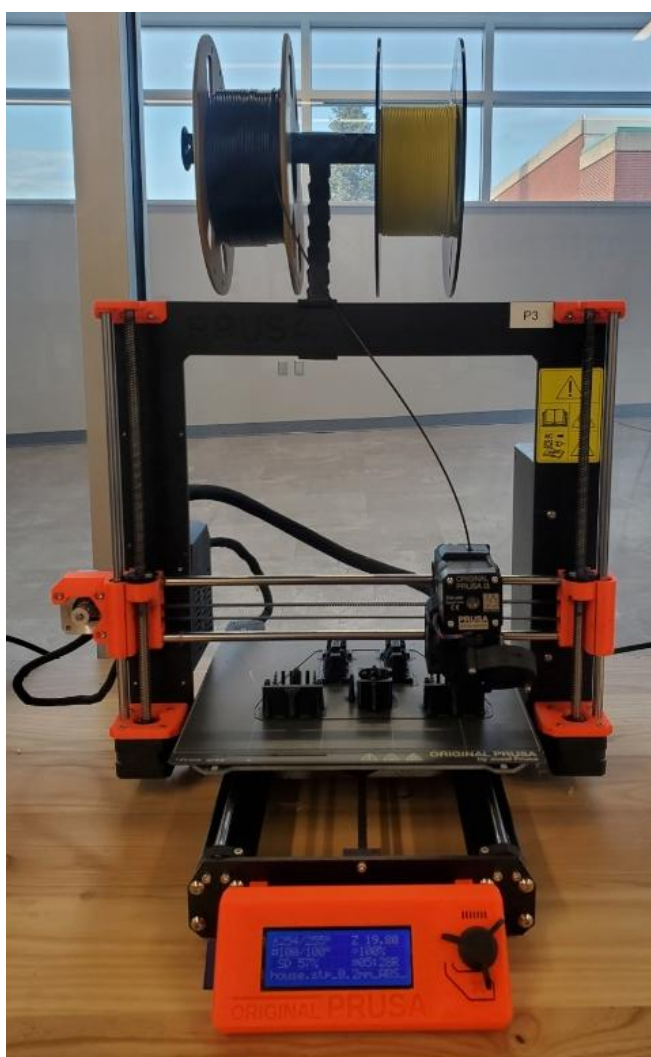


Unaltered weapon disc (left) next to harden disc (right)

Completed weapon assembly with safety components



3D Printing



Electronic housings printed out of ABS and the wheels of TPU

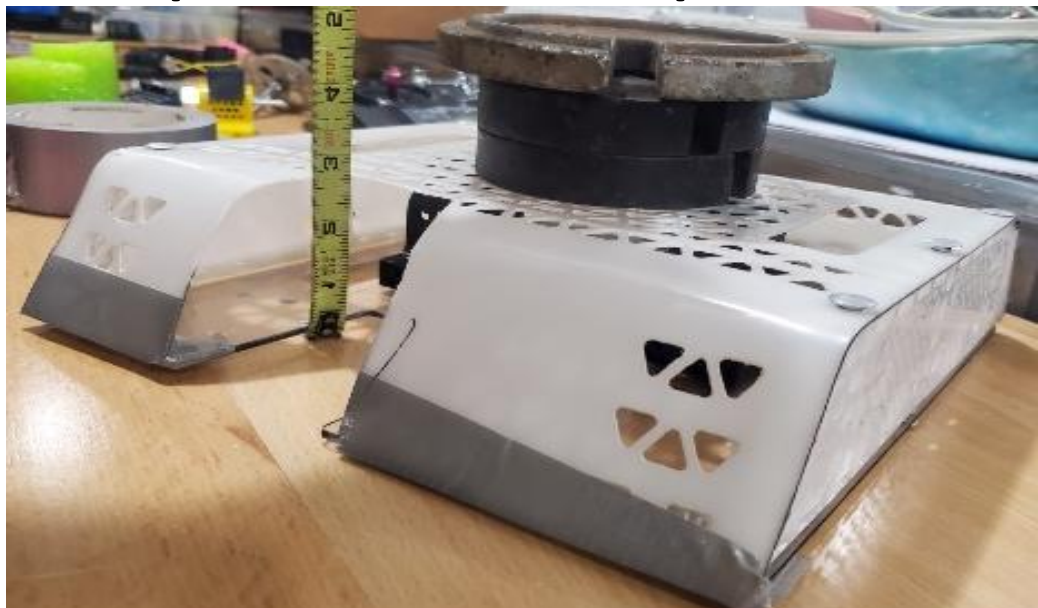


Rough layout of printed housings and electronics on robot

Testing and Validation

Housing:

- Drop Tests – 3 to 6 feet
- Deflection testing – 1/8” max
- Durability Test – Held against weapon at 500 rpm



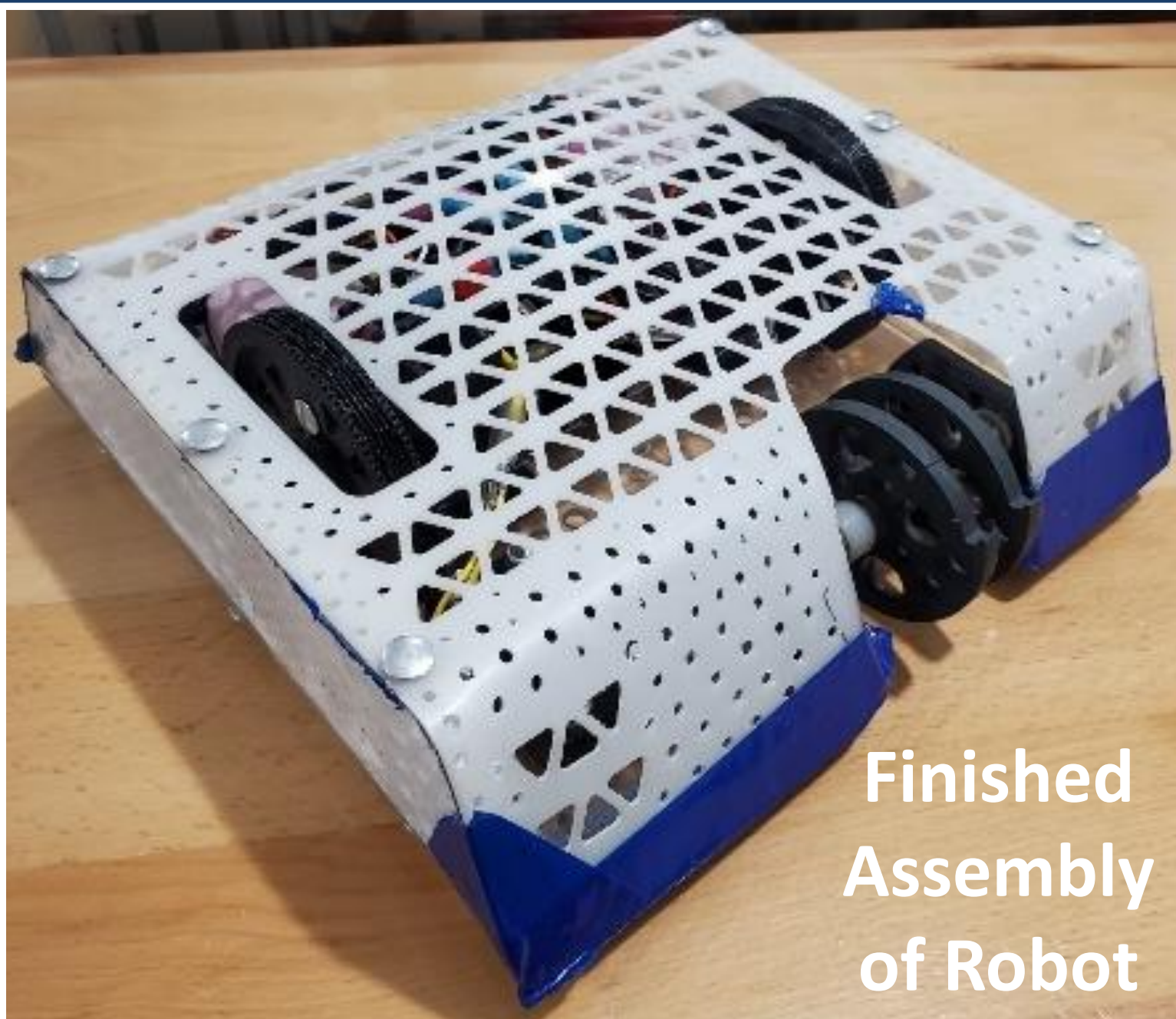
Weaponry:

- Epoxy Testing – 40 lb.
- Rockwell Hardness test – 60 HRA
- Weapon Speed – 626 rpm CW & 590 rpm CCW



Operation:

- Speed – max 970 rpm forward & 940 backwards
- Operational Speed: 5.7 ft/s
- Runs upside down – yes



Finished Assembly of Robot

Sizing:

- Weight – 2 lb. 15.1 oz
- Dimensions – 10”x10.75”x3.75”

Acknowledgments

A special thank you to all who have supported the team:



- MAE Department
- Dr. Darryl Webber
- James Taylor
- Christina Boggs

