2023-2024 Combat Robot

Mechanical and Aerospace Engineering
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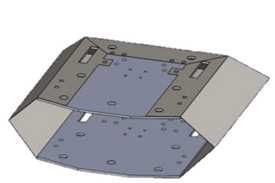
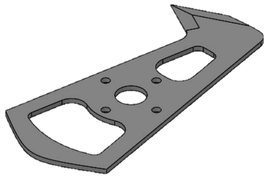
Abstract

The main objective of the 2023-2024 combat robot team is to compete and win the National Robotics Challenge (NRC) in Marion, Ohio on April 18th, 2024. They will compete in the Beetle Weight division and must adhere to all 2023-2024 NRC specifications and requirements to be qualified to compete. During the competition, the team's placing will be decided by a bracket-based elimination tournament. The budget for the project will be $700 along with any additional funding provided by sponsorships and donations.

Customer Needs and Requirements

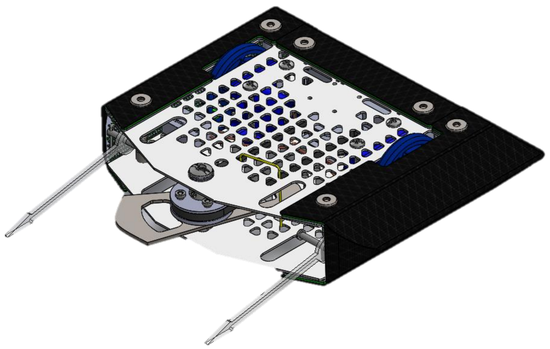
- Win National Robotics Challenge Combat Robot Competition
- Low manufacturing cost
- Modular and easily repairable
- Maximum Size: Not exceeding 14" x 14" x 14" space
- Maximum Weight : 3lb (Rolling/Wheel Drivetrain)
- Adherent to all NRC outlined safety specifications
- Maximum Voltage: 48 V
- LED light must be visible during operation
- Maximum height of weapon contact: 5" above ground

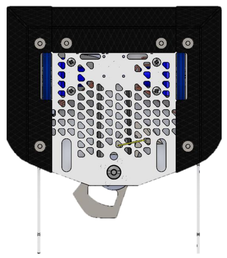
Concept Selection

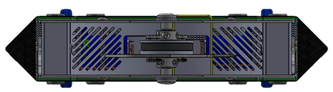

	Housing	Weapon	Drivetrain
Style	Sloped Rectangle	One-Tooth Counterbalance Horizontal Spinner	Wheeled
Material	Polycarbonate, PETG & TPU	Hardened O1 Tool Steel	PETG & TPU

Design Solution


Isometric View


Top View

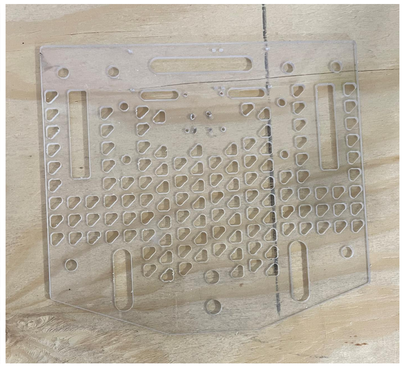

Side View


Front View

Manufacturing

Housing

3D Printed Side Panel Shear Proofing
- Carbon Fiber Weave on TPU Armor
- Epoxy Resin and Hardener

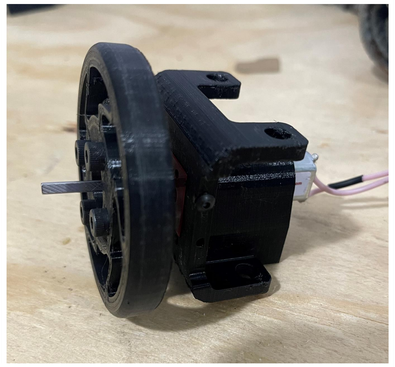


Polycarbonate Top Armor Panel
- Cut using WaterJet

Weapon

- Hardened at 1200° F
- Quenched in Canola Oil
- 3D Printed PETG Pulley

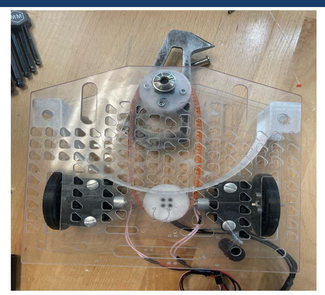
Drivetrain



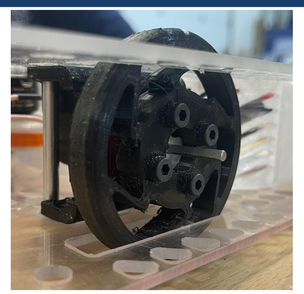
- Shock Absorbent Spokes
- TPU 3D Printed Wheels
- PETG Motor Mounts

Testing and Validation

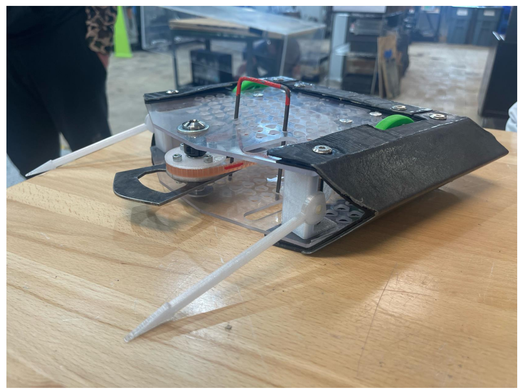
Housing
- Drop Tests – 1 to 5 ft
- Impact Tests – Survived at 460.86 lbf
- Combat Simulations



Weapon
- Tachometer – 2166.1 RPM average
- Rockwell Hardness Test – 58.2 Rockwell C Average
- Weapon Impact Force – 38.23 lbf using MATLAB



Drivetrain
- Speed of 1.86 ft/s
- Impact Test – Survived at 257.6 lbf



Final Assembly

Acknowledgments

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