

Abstract

The combat robot project is for a competition held in Marion, Ohio where teams from different schools across the country compete in a competition like the show BattleBots, where all the robots must be under three pounds. A circular robot was created with a polycarbonate body, with three arms spinning about a central drive shaft which was lathed in-house. The arms were cut and thermoformed and the body was vacuum formed over a laser cut mold. The battery packs were custom made from single-cell lithium-polymer batteries, and the circuit board was also custom designed and printed. This combination of components comes together to create a durable and powerful robot that allowed us to be undefeated and get first in competition.

Customer Needs and Requirements

- Must weigh less than 3 lbs
- Must fit in a 14" x 14" x 14" space
- Must be able to be completely turned off in under 60 seconds
- Weapon must have a bright colored lock when not in use
- Robot must have a light to indicate that it is powered on
- Spinning weapons cannot be higher than 5in from the floor
- Battery last longer than 4 minutes
- Max ground clearance of 3/8"
- Robot must drive at least 2 mph



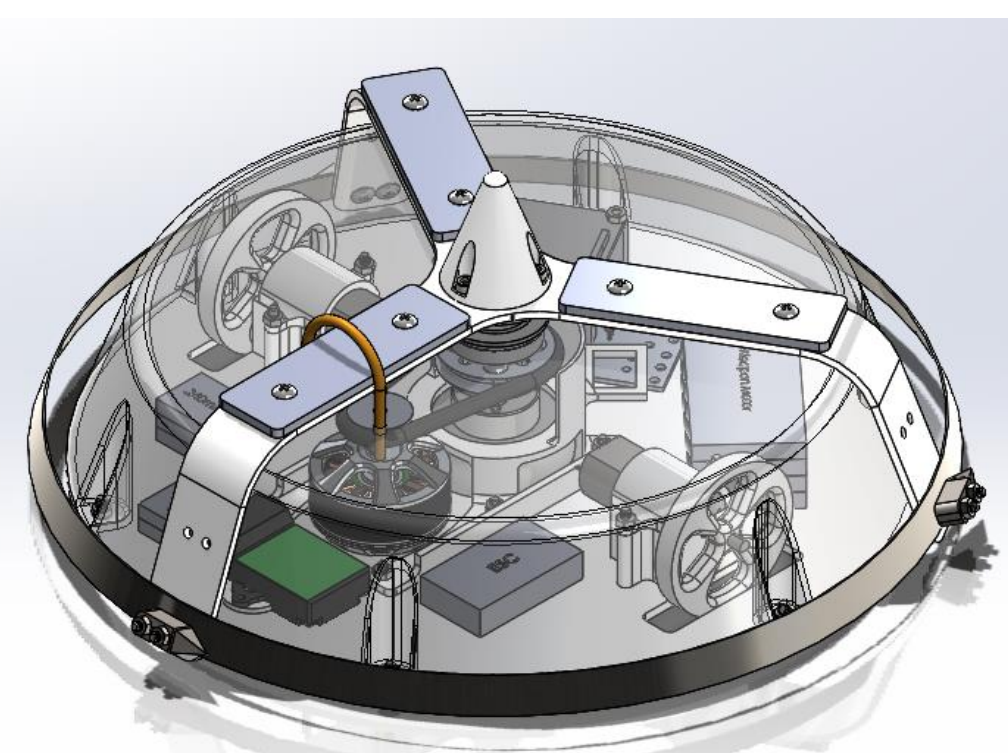
Concept Selection



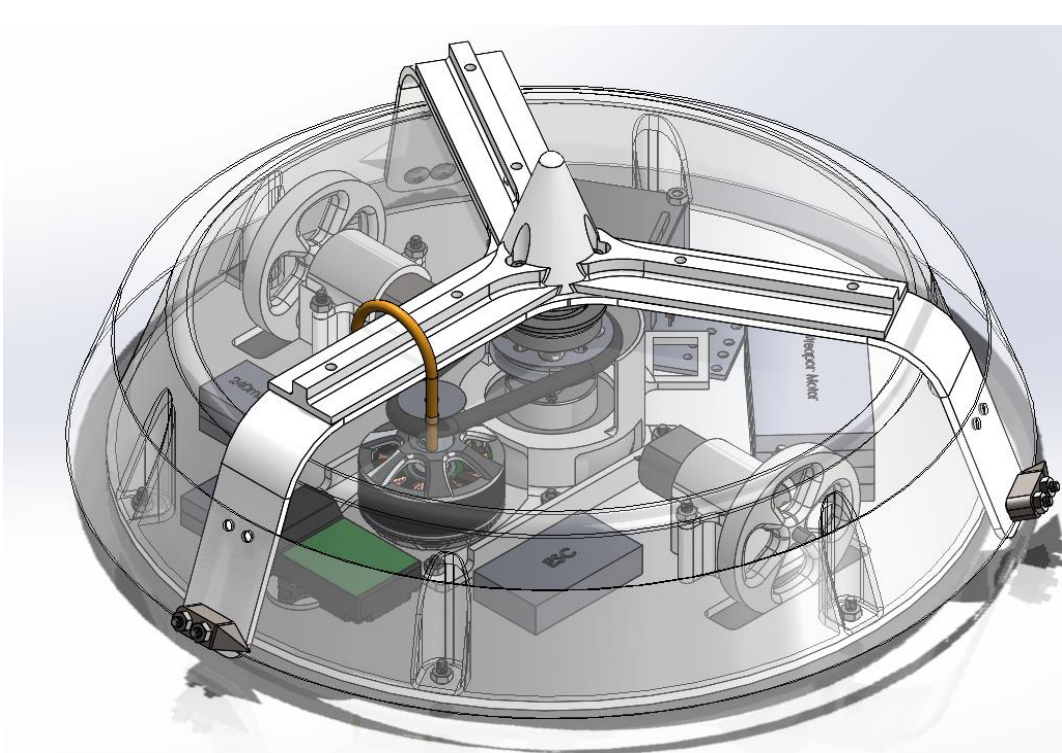
- Shell: Polycarbonate
- Weapon: Polycarbonate / S7 Tool Steel
- Weapon motor: Tmotor MN3508 DC brushless motor
- Drive motors: 12V DC 550 rpm Brushed Motor
- 3 Batteries for systems
 - 4s Lipo 1000mAh
 - 3s Lipo 240 mAh
 - 2s Lipo 240 mAh

Design Solution

The final design solution involved a circular bodied robot with an outer spinning ring, on which sharp metal teeth were mounted. The teeth spin at high speeds, impacting enemy robots to send them flying or to tear them apart. The polycarbonate arms and body absorb enemy hits, preventing damage to the electronics within.



Mid-development iteration



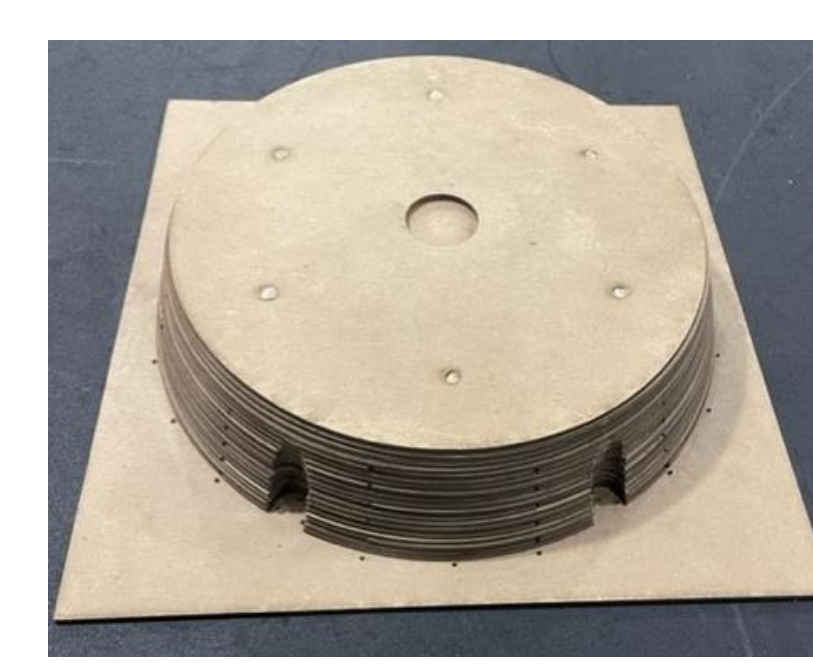
Final development iteration

Manufacturing



Center Shaft:

- Lathed with multiple steps and tight tolerances to fit specific dimensions.
- Drilled holes to connect shaft to pulley and weapon.



Shell:

- A mold was made by laser cutting multiple pieces to put together.
- The mold was used to vacuum form the polycarbonate.



Iterations:

- The Bearing mount, top weapon braces, and ring went through multiple iterations trying to find the optimal design for durability.



Final completed robot

Testing and Validation

Test 1: Battery

- Test run time when fully stalled: 10min
- Battery % > 50%

Test 2: Speed

- Time to drive 10ft: 3 seconds: ~2.3mph
- Running Start: 2.5 seconds: ~2.75 mph



Robot Speed Test

Test 3: Drop

- Drop from 3 ft
- 0° drop
- 45° drop
- 90° drop
- 180° drop



Robot Drop Test

Test 4: Damage

- Threw the enemy test robot across the arena



Damage Test

Test 5: Durability

- Weapon was still functional after impact.



Weapon Durability Test

Acknowledgements

A thank you to our sponsors, whose contributions were crucial to our success:

