

# Combat Robot

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## Abstract

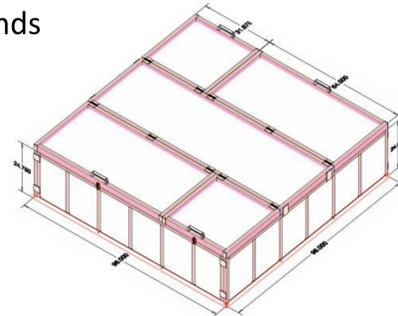
A team of mechanical engineering students designed and built a combat robot to compete in the National Robotics Challenge (NRC) combat robot competition. This project was designed to meet the size, weight, and safety requirements set by the NRC.

During the fall semester, the team designed a complete robot in CAD and created a MATLAB program to determine the necessary requirements to fully power the electrical components of the robot.

In the spring semester, the team manufactured all necessary components and constructed the robot.

## Customer Needs and Requirements

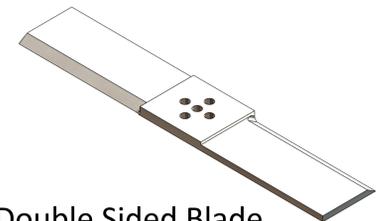
- The robot must fit within a 14" x 14" x 14" space.
- The robot must weigh no more than 3 pounds.
- The robot must be deemed safe to compete by an NRC judge
- Have a response time under .05s
- Must be able to take a 300 lb. force
- Be able to attack every 3 seconds



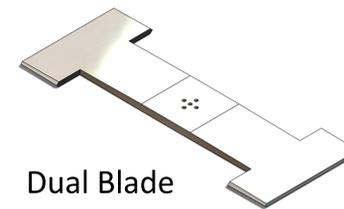
## Concept Selection



Shell Spinner



Double Sided Blade

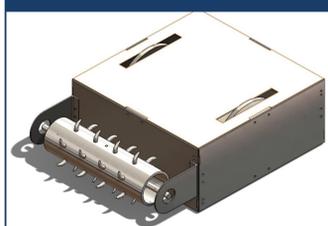


Dual Blade



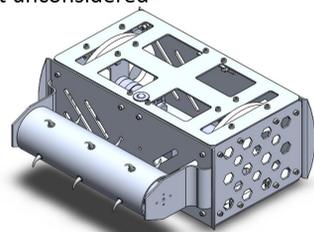
Spike Drum

## Design Solution

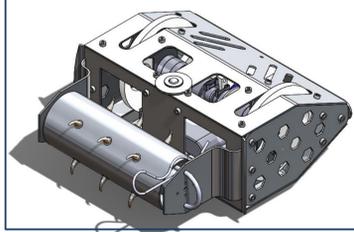


- First Iteration
- Basic Design
  - First Drum Idea
  - Weight unconsidered

- Second iteration
- Weight reduction
  - Rolling solution
  - Weapon attachment vague plan

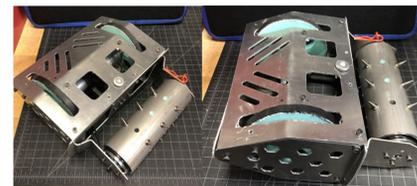


- Last iteration
- Tapered Back
  - Decreased Drum Length
  - Wheel Clearance Increased
  - Strengthened Frame Support



## Manufacturing

Shell



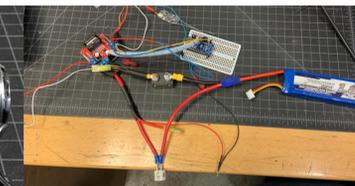
- Material
- 2024-T3 Aluminum
  - Carbon Fiber Infused Polycarbonate
  - PLA
- Manufacturing
- Plasma Cut Metal
  - 3D Printed Parts

Weapon Drum

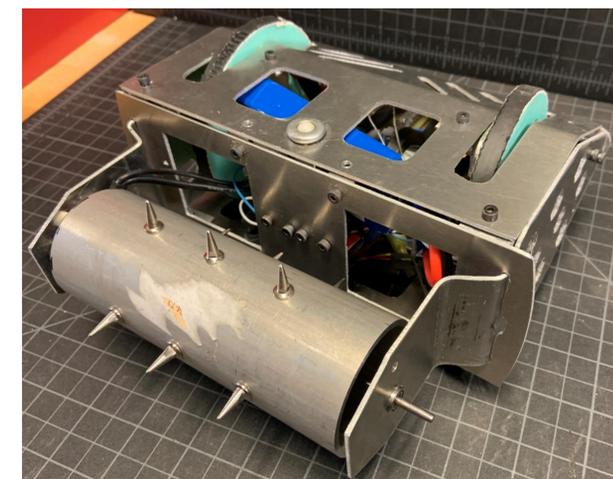


- Material
- 2024-T3 Aluminum Tube
  - Steel Track Spikes
  - PLA/CFIP
- Manufacturing
- Lathed/Milled Drum
  - 3D Printed Drum Core

Electrical



- Components:
- 2 DC brushed motors
  - 1 Brushless motor
  - Motor Driver
  - Receiver
  - Arduino Nano
  - Battery
  - ESC



- Final Weight
- 2.85lbs

## Testing and Validation

### NRC Rules:

- Met size and weight requirements
- Included fast disconnect
- Had power indication LED
- Stopped spinning within allotted time
- Has a removable pin that keeps the weapon from spinning

### Code Testing:

- Made sure all motors are controlled by remote
- Made sure drive motor speed could be varied
- Checked safety features
  - Weapon safety
  - Don't spin when not connected

### Weapon Testing:

- When the spikes contacted the aluminum, they were extremely effective
- Verified it was able to stop spinning within 60 secs
- Verified that the weapon could attack every 3 seconds.



## Acknowledgments

Thank you to Priline, Joe Thompson, Dr. Liu, Trine Robotics Club, Dr. Mitofsky, Justin DeClark and Clayton Wilson