

Project 22: 30 lb Combat Robot, "Thunderstrike"

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Objective

To meet requirements for and compete in the 2nd annual Bengal Bot Brawl and advance to the Momo Con Robot Battles Featherweight Championship.

Background

Thunderstrike is in the 30 lb weight class of combat robots. The robots battle on a stage using weapons to defeat competitors. The robot must meet weight requirements, show mobility, and operate within the combat volume. A robot is defeated if immobile or entirely outside the combat volume. In April of 2018, LSU hosted the Bengal Bot Brawl in which Thunderstrike came in second place.

Key Functionalities

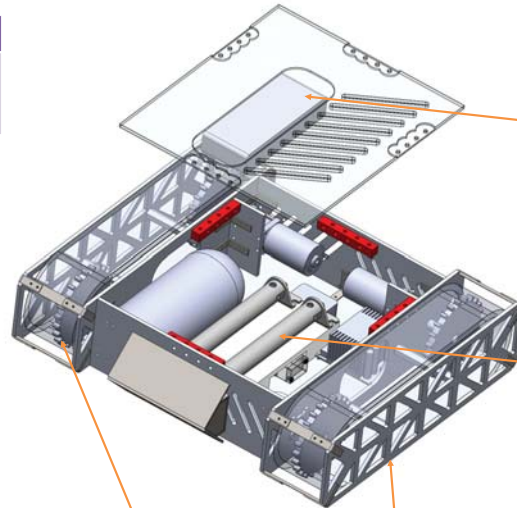
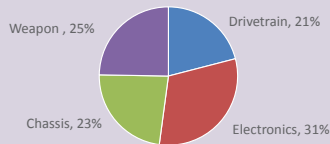
Movement	Track system with superior traction and turning abilities
Attack	Pneumatic ram actuates to displace opponents
Defend	Agile drivetrain evades / operates when flipped
Safe Operation	Kill switch cuts off power in case of emergency

Safety

- Appropriate PPE worn during all manufacturing and operation
- LiPo batteries stored in fireproof bags
- Metal chassis edges filed to prevent cuts/abrasions
- Pressurized air tanks secured during filling and operation
- ESC automatically shuts off in the event of signal loss, cutting power to motors

Budget

Total Budget: \$2000.00
Total Expenses: \$1989.98



Power & Communications

- 8000 mAh LiPo battery
- 60A Regenerative motor driver
- Receiver located on robot, controls electronic speed controller
- Hand held 6-channel controller with 2.4 GHz frequency

Weapon

- Pressurized Air Tank:**
- Rated pressure: 3000 PSI
 - Operating pressure: 120 PSI
- Pneumatic Cylinders:**
- Dual 4" stroke cylinders
 - Rated pressure: 145 PSI
 - Operating pressure: 50 PSI



Drivetrain

- 3" rubber track system
- 4.5" diameter sprockets
- 2 RS-540 motors (4.47 oz-in)
- 38:1 gear reduction

Chassis

- Al 7075-T6 body, 1/5" thick
- "Unweldable" aluminum due to microcracking > bolts and brackets



Manufacturing

- Aluminum water-jet cut and bolted with brackets
- ¼-20 Nutstrip allows quick top armor removal
- Custom hand assembled tank drivetrain
- Air tank hose-clamps > easy refill/replace between rounds
- Piston support custom milled to eliminate singularities
- MIG welded 1/16" steel weapon head
- Motors soldered with 8 AWG wires

Improvements

- Vibration reduction to prevent air leaks
- Track armor redesign to improve contact with ground while lifted by opponent
- Air compressor upgrade to increase maximum operating pressure
- Use of thinner sheet metal on chassis (weight allotment)
- Improve material compatibility on sprockets

Testing and Validation

- Finite Element Analysis of chassis and multiple 2' drop tests
- Pre-assembly pneumatic tests for force output and actuations per tank
11 effective actuations (>30lb) at tank pressure of 120psi
- Battery test for capacity and current discharged
- Motor test for torque and RPM
Within ± 10% of manufacturer values
- Temperature testing of motor
<120°F after 2hr of heavy usage



September

- Concept Generation

October

- Concept Selection & Refinement

November

- Design and Drawings Finalized

December

- Component Ordering

January

- Begin Assembly

February

- Complete Assembly

March

- Testing

April

- Testing, LSU Competition

Sponsor: Valero, Mr. Jack Rettig

Advisers: Dr. Hunter Gilbert, Dr. Jerry Trahan