Culverizer

April 2022 - Present



AT A GLANCE

TYPE & WEIGHT
Horizontal spinner / 3 lb / Beetleweight

VERSION
v4.2

WIN RECORD
18-15 / 54.5% winrate

COMPETITIONS
7 tournaments

ENERGY STORED
700 J

My role

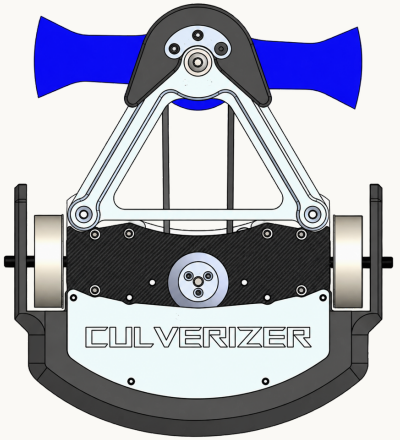
Lead Engineer: design, manufacturing, electronics, & testing
Competition strategy and drive coach

Culverizer / continued

Design approach

I designed Culverizer around an offense-first strategy, using a heavy, hardened steel blade to destroy opponents' wheels and batter their weapon assemblies.

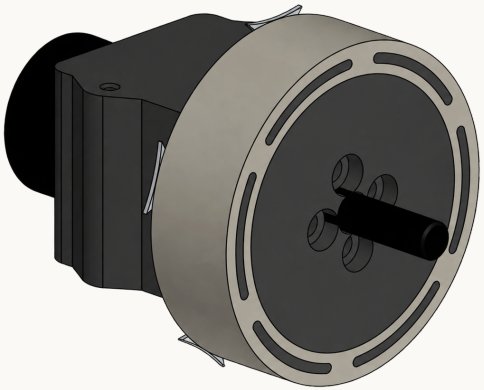
Carbon-fiber plates provide chassis rigidity and support the weapon assembly, while the 3D-printed 95A TPU body flexes to absorb and disperse impact energy. The TPU serves as sacrificial armor, taking damage to protect the internal electronics.



Drivetrain

Brushless motors propel Culverizer at 12 mph. TPU shock mounts let the motors deflect under impact, directing energy away from the gearboxes to extend their lifespan.

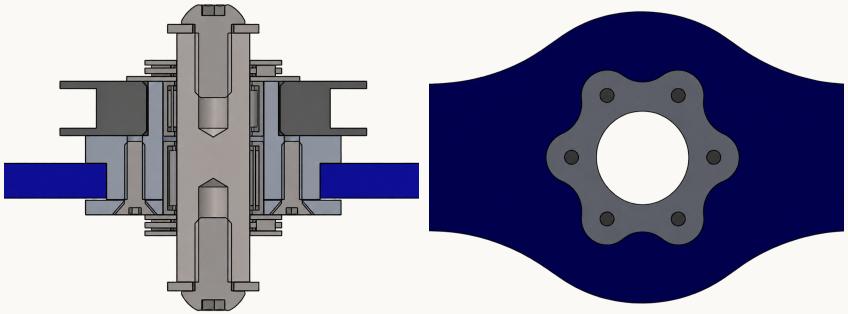
I made custom molds for 2.1-inch wheels with impact-absorbing TPU cores and 45A urethane treads. The urethane adheres to the TPU and provides traction and acceleration; 1/32-inch spring-steel "spiked cleats" further improve traction and control. The compliant cores also help protect the wheels and gearmotors from impact.



Culverizer / continued

Weapon Assembly

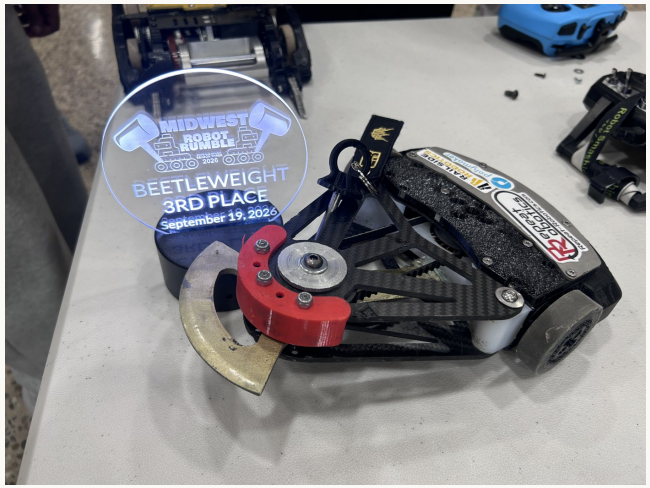
A 600 kV motor at 25.2 V drives the blade through a 6:5 belt reduction, reaching a measured 220 mph and storing 700 J of energy. The flat timing belt allows the assembly to slip on impact, reducing shock transferred to the motor. A spline pattern transfers torque to the blade.



Competition Results

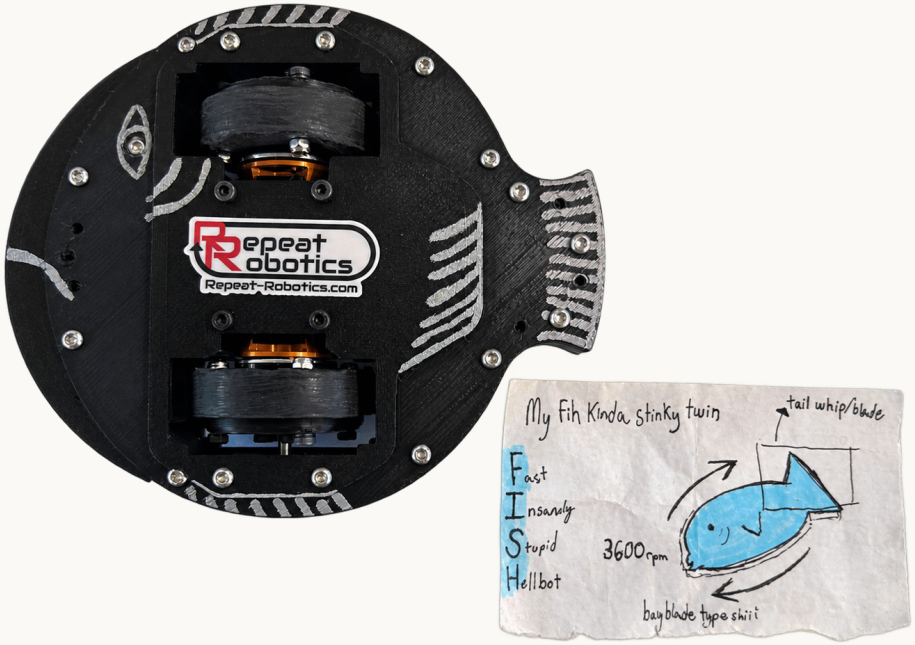
I built three working copies of Culverizer, configured to counter different opponent build styles. Across seven competitions, v4.2 earned an 18-15 record (54.5% win rate), including two third-place finishes.

Watch Culverizer in action



FIH

September 2026



AT A GLANCE

TYPE & WEIGHT
Melty brain / 1 lb / Plastic antweight

VERSION
Buildathon

WIN RECORD
4-2 / 66.7% winrate

COMPETITIONS
2 Buildathon competitions

ENERGY STORED
Unknown

My role

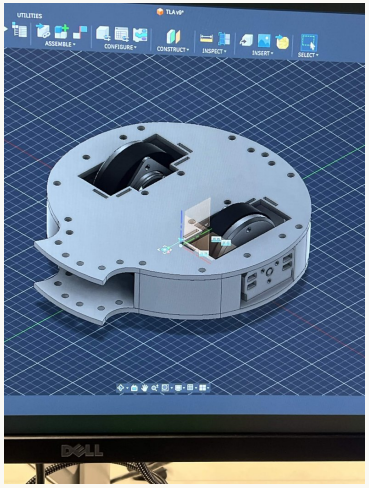
Team of two; I led much of the design, focusing on drivetrain and chassis.
Kavan Ramaswamy designed the wheel mounting and handled assembly, soldering, and wheel manufacturing.

FIH / continued

Design approach

At Railside Robotics' 48-hour Buildathon over Labor Day weekend in September 2026, each team received 1 kg of PLA to build a one-pound plastic antweight. Our two-person team was given a fish-shaped sketch as our assigned design. The challenge was to interpret it and match the drawing as closely and thoughtfully as possible. Because the sketch resembled a melty brain, we chose to make it function as one, competing after 24 hours and again at 48 hours.

I led much of the design, focusing on the drivetrain and chassis. We used Fusion 360 because Kavan was more proficient in it; although I was more familiar with SolidWorks, I adapted quickly so we could collaborate. Kavan designed the wheel mounting and handled assembly, soldering, and wheel manufacturing.

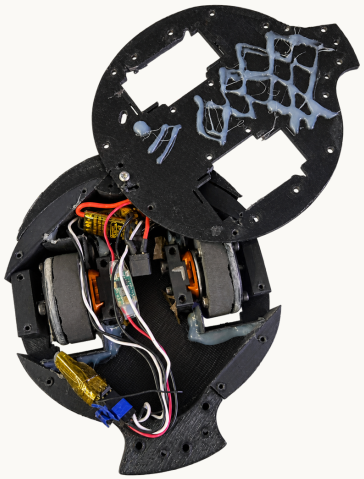


Building and driving a melty brain

A typical melty brain uses a controller to measure rotation and pulse the motors for translation. Without that controller, I manually varied the relative speed of the two drive motors while driving. The approach required estimation, but produced useful translation and let me line up shots.

Balance was a key challenge. We designed for balance in CAD, then added screws as ballast to adjust the center of gravity. We also designed the PLA motor mounts with enough material around the motors to withstand heat when they stalled; the mounts held up.

To work within the tight deadline, we designed chassis components as flat pieces rather than tall parts. Printing with less height let us iterate faster and produce spare parts in time for competition.



FIH / continued

Testing and iteration

After the 24-hour competition exposed chassis structural issues, we added material along the weapon-impact load path. The revised chassis held together well in the second competition.

In the second competition, foam wheels failed and screws backed out. We reduced wheel speed for the next match, but could not fully resolve the issue during the event. In a future revision, I would use a more robust wheel material, improve screw retention, and consider lower-kV motors: the available motors were operated at about 30%, and the robot experienced heating and stalls.

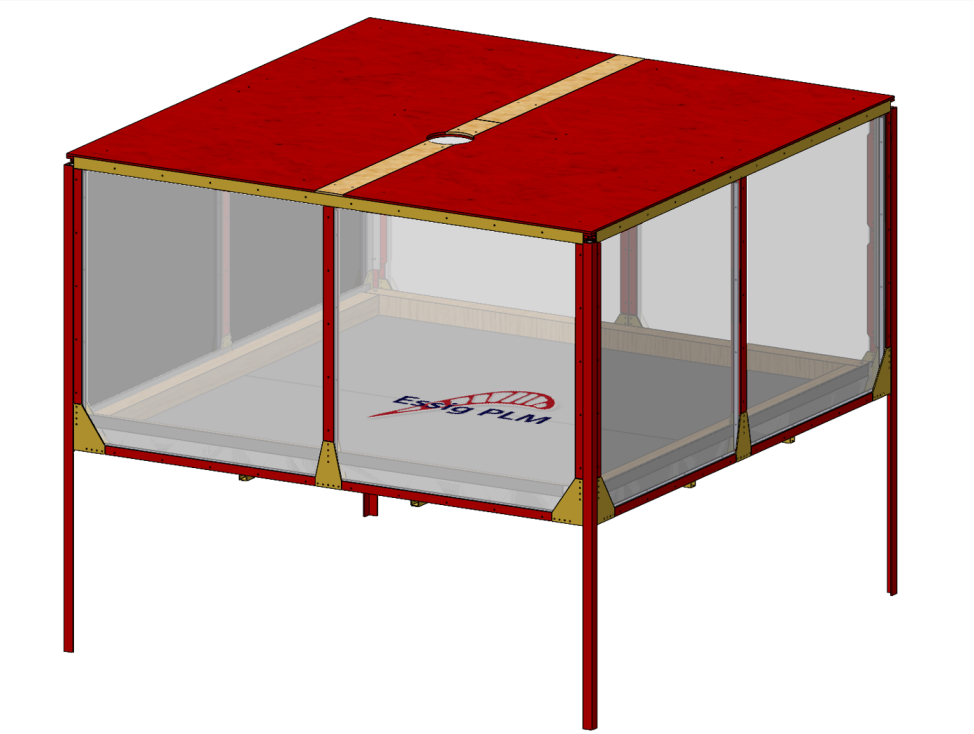
Competition Results

FIH went 3-0 and won the 24-hour competition. At 48 hours, it went 1-2; both losses involved motor stalls and a depleted battery. Across both competitions, the combined record was 4-2.

Watch FIH in action

Beetleweight Arena

April 2024 - April 2025



AT A GLANCE

COMBAT FOOTPRINT
8 x 8 ft

SETUP TIME
1 hour

FIGHTS HOSTED
105

FINAL COST
$7,000

MANUFACTURING TEAM
20 members

My role

Project lead: structural design, requirements verification, and tool and component sourcing
Manufacturing lead: coordinated three manufacturing leads and a 20-person team

Beetleweight Arena / continued

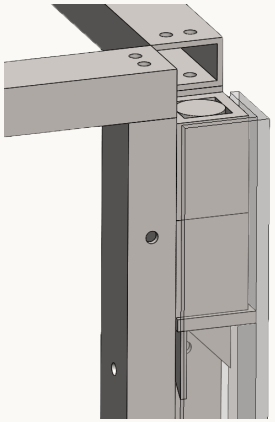
The challenge

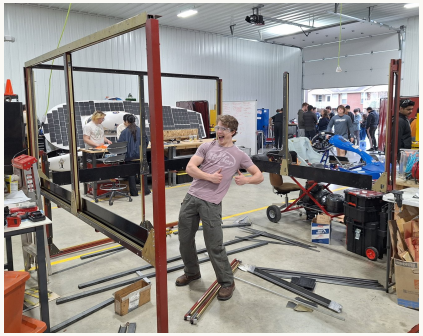
I led the design and construction of a new arena for Purdue's combat robotics club, Railside Robotics. It needed at least 64 square feet of combat space, clear viewing, quick repairs, and a $10,000 budget. Because our workshop and competition venue were four miles apart, transport and setup were central design constraints.



Assembly and transport

I designed an 8 x 8 ft arena with 4 ft walls and an elevated floor for viewing. To fit a 4 x 8 ft trailer and speed setup, I divided the frame into flat-packed sections that stack at peg-and-tube joints without installing fasteners. Slide-in panels let members assemble different sections in parallel; the team met its one-hour setup target twice.

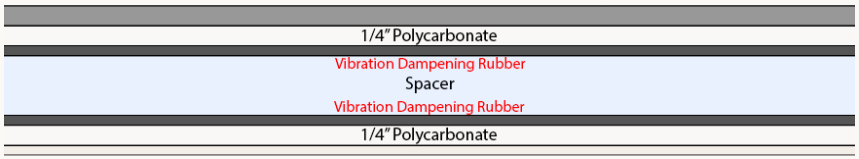




Beetleweight Arena / continued

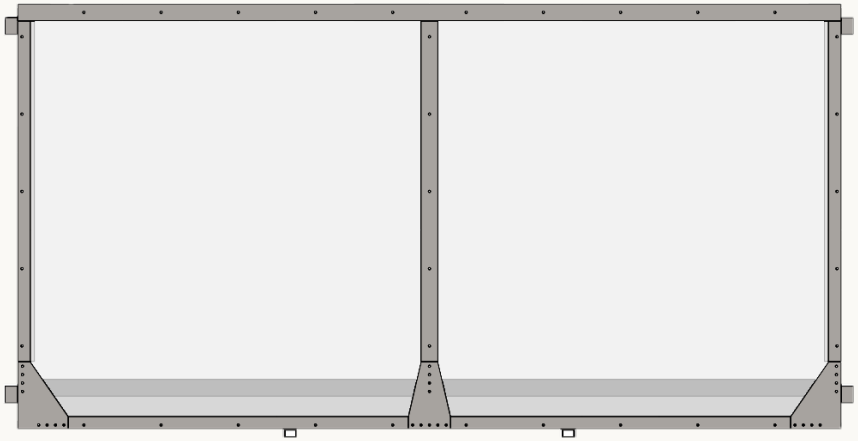
Designing for safety

I specified two layers of 1/4-inch polycarbonate with a 1-inch air gap to reduce the chance of a breach. An 800 cfm extraction fan provides ventilation for battery-fire fumes.



Designing for repairs

I split the polycarbonate walls into 4 x 4 ft panels so local damage would require replacing less material. Top-loading panels and replaceable floor sections make repairs accessible during an event. For Railside Rumble 2, we added mild-steel kickplates to prevent robots from getting stuck in the kickplates.



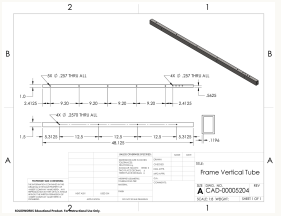
Beetleweight Arena / continued

Manufacturing and collaboration

I coordinated three manufacturing leads and a 20-person team manufacturing more than 40 unique parts using CNC mills, lathes, laser cutters, and welding. I used drawings to communicate requirements, trained members in Aras Innovator PDM, and linked drawings to part documents so the team could coordinate fabrication. The completed arena cost $7,000 against a $10,000 budget.







Results

The completed arena has hosted two competitions, with no breaches or maintenance required during either event. We revised and strengthened the floor's structural supports and the ceiling supports after the initial design to improve rigidity. The team has assembled the flat-packed arena in one hour; another competition is scheduled for November 14, 2026.

Watch competition highlights

