# CASEY FRANTZ

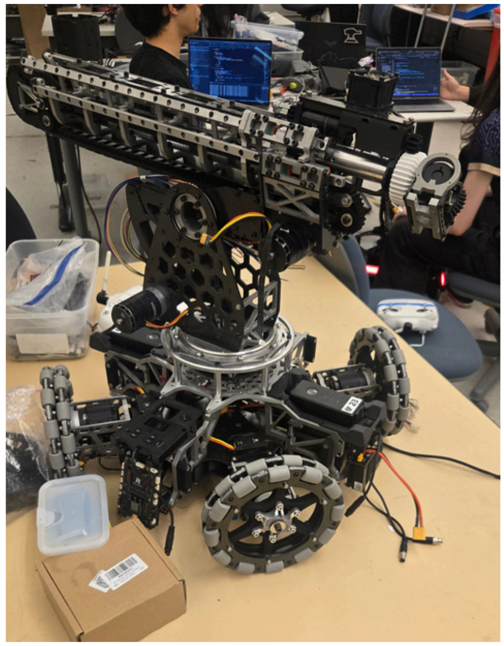
FUTURE MECHANICAL ENGINEER STUDYING AT THE UNIVERSITY OF WASHINGTON

## ARC Robotics Competition - Advanced Robotics at UW

As one of six team members, I contributed to the design and construction of a 0.6 × 0.6 m, 20 lb robot built for a competitive challenge requiring precise cube manipulation and placement. This project demanded careful consideration of mechanical tolerances, hardware selection, and control systems to achieve high accuracy.

Key Features:

- 5 rotational axis enabling versatile manipulation
- Cascading arm design with ~1 m reach
- Electrical and pneumatic slip rings on turret yaw and wrist roll for continuous rotation
- Three passive encoded omni-wheels providing precise odometry
- Suction-based end effector for reliable object handling

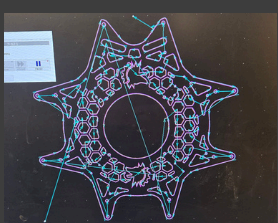


## My work

Full Manufacturing life-cycle experience with plate and cylidrical geometries

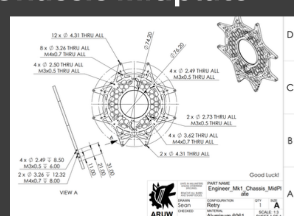
**Manufacturing** | Design

### Chassis Midplate

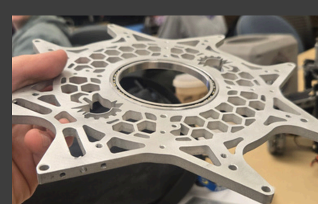


Waterjet operation

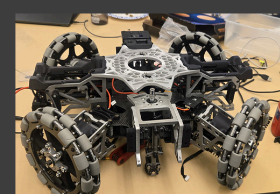
surface post-processing



Part drawings using GD&T principles



Machining and tapping with fixture plate



Assembly

### Turret bearing stack plates

2-axis conversational milling

precise bearing press-fits

### Wrist Tube

Part requiring lathe and mill operations

Full assembly of my designed wrist mechanism

# CASEY FRANTZ

FUTURE MECHANICAL ENGINEER STUDYING AT THE UNIVERSITY OF WASHINGTON

## ARC Robotics Competition - Advanced Robotics at UW

### My work

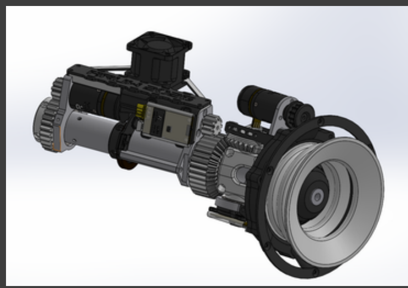
Manufacturing

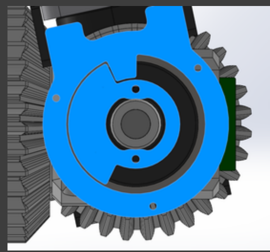
Design

#### Main Project:

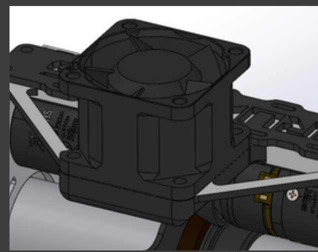
2-DOF Wrist Mechanism (Primary Contribution)

- Continuous 360° roll via slip-ring integration
- 180° pitch → hemispherical orientation workspace
- Low backlash, high stiffness design through gear iteration
- On-axis encoding for precise control

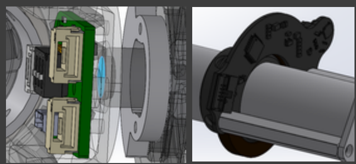




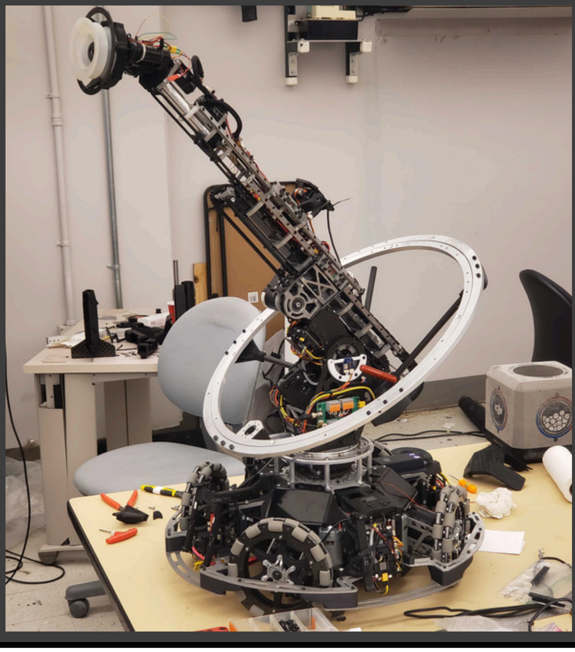
Hardstops for safety and fallback while testing

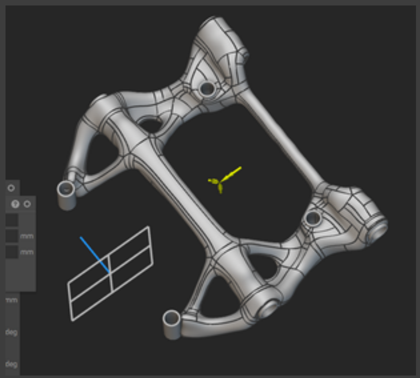


Active cooling for stall condition

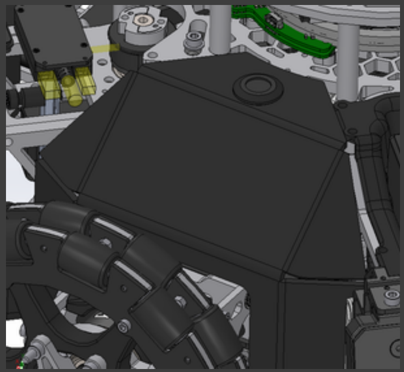


On-axis encoding





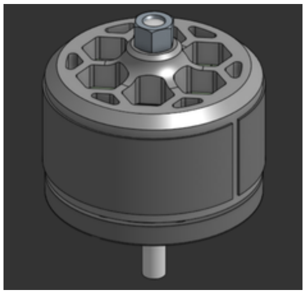
Topology optimized electronics mount (nTop)

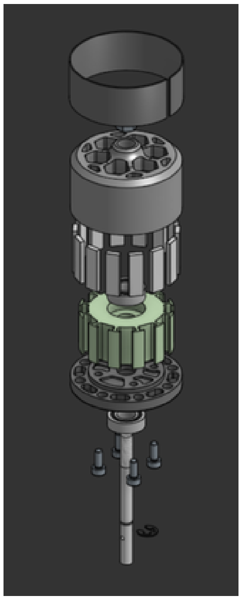


Electronics Covers

## BLDC Motor Project - Learning Project (In progress)

- Designed a fully 3D printed BLDC motor
- Implemented flux loss solution from plastic stator by adding steel ring
- Balanced turn count vs slot fill to hit ~150 Kv at 24V

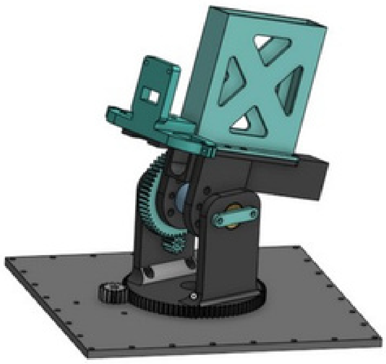


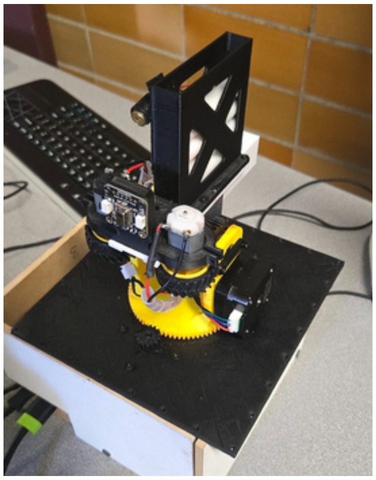


# CASEY FRANTZ

FUTURE MECHANICAL ENGINEER STUDYING AT THE UNIVERSITY OF WASHINGTON

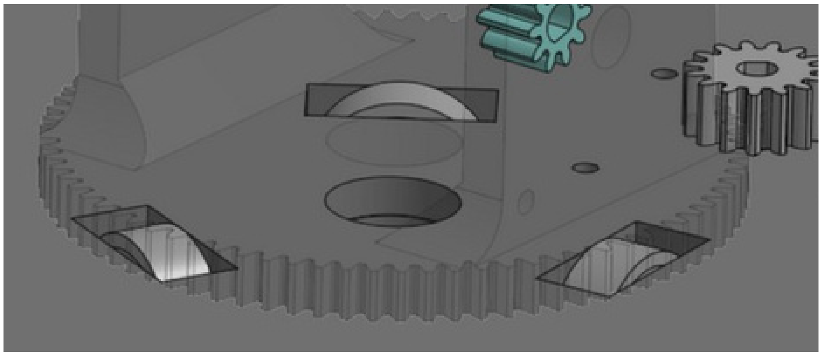
## 2 DOF Nerf Turret- Hardware Hackathon





**Overview:**
**A two-degree-of-freedom Nerf turret capable of 360° motion in the XY plane, featuring a gravity-fed magazine and custom thrust bearing for smooth rotation. The system was controlled through a combination of motors, servos, an Arduino, and a Raspberry Pi.**

**Design Process:**
**The turret was designed, 3D printed, and assembled within 24 hours during a hackathon. I created multiple indexer designs for the servo-driven rotation system to improve rigidity, precision, and tolerance control. Rapid iteration and modular design allowed for quick troubleshooting and optimization during assembly.**



**Result:**
**My team won 2nd place out of 40 teams with high scores in complexity and completeness. We made multiple design considerations for the next iteration of this project such as improved motor and mounting for the shooting mechanism**

**Technical Highlights:**
**Tools: SolidWorks, Arduino IDE, Raspberry Pi**
**Skills: 3D printing, servo control, CAD modeling, mechanical integration**
**Methods: Rapid prototyping, tolerance optimization, embedded system control**

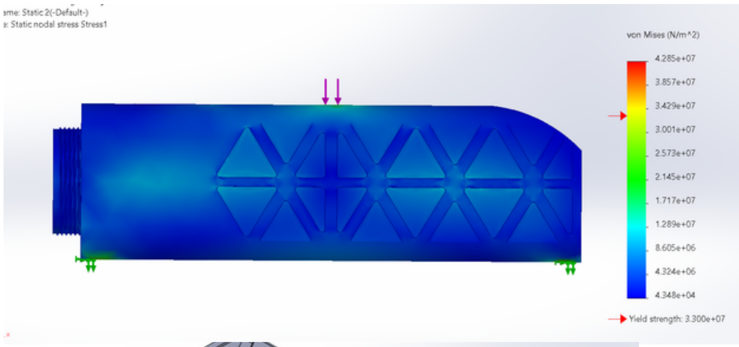
# CASEY FRANTZ

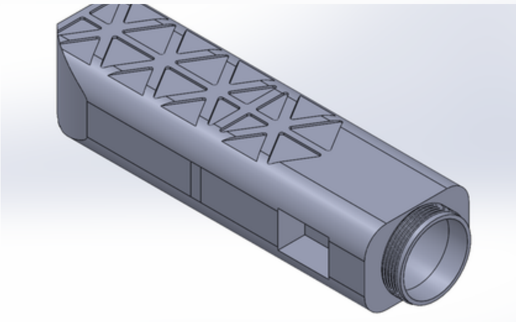
FUTURE MECHANICAL ENGINEER STUDYING AT THE UNIVERSITY OF WASHINGTON

## Flashlight Body Optimization - Class Project

**Overview:**
Collaborated with a team to design and optimize a lightweight flashlight body capable of withstanding a three-point bend test. The objective was to minimize deflection under load while maintaining a low overall mass.

**Design Process:**
Using SolidWorks Simulation (FEA), I performed design studies to evaluate different cross-sectional profiles, wall thicknesses, and material distributions. Through iterative refinement, I identified and reinforced high-stress regions while reducing unnecessary mass. The optimized geometry achieved the 3rd lowest deflection-to-weight ratio among all competing designs, demonstrating exceptional stiffness efficiency and strong performance relative to weight.



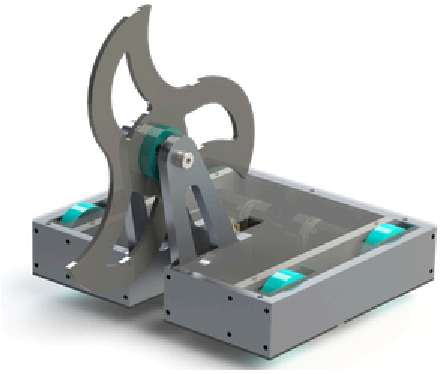
Tools: SolidWorks Simulation, Design Studies
Skills: Finite Element Analysis (FEA), lightweight design, structural optimization, stress evaluation
Methods: Three-point bend testing, iterative simulation, performance benchmarking

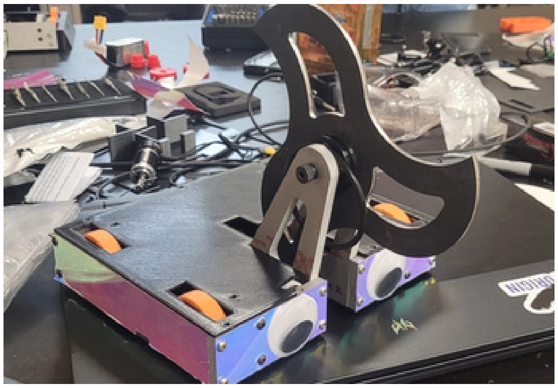
## Beetle Weight Battlebot - Crimson Robotics

**What?**
3 lb battlebot which was designed, built, and programmed all within limited time over 2 months. I have developed most parts of the CAD model which includes drive and weapon functionality.

**How?**
Robot concept was first drafted using Onshape which then was converted over to Solidworks. We looked over 3 itterations of drive base and a weapon design before arriving upon our final design choice.

**Result.**
Robot was entirely functional but had issues particularly with interference of motors and electronics along with fragility of motor mount design. This experience was a great learning opportunity.



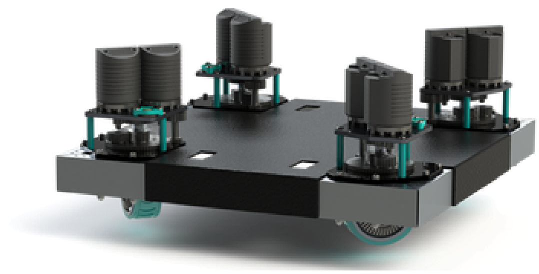


# CASEY FRANTZ

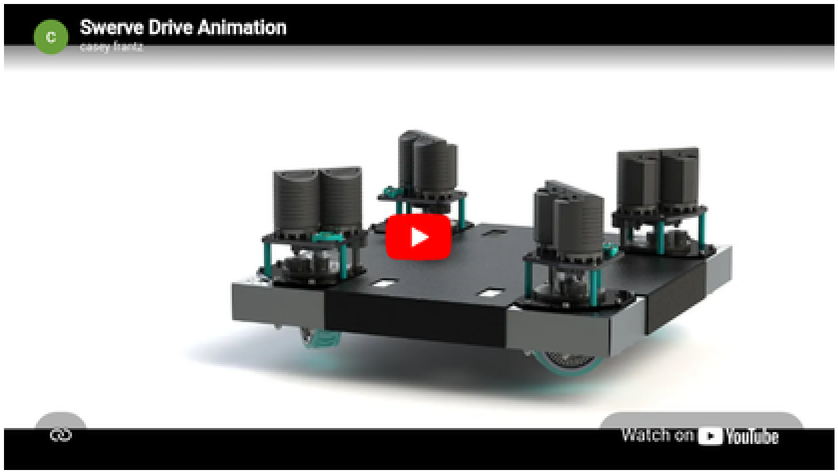
FUTURE MECHANICAL ENGINEER STUDYING AT THE UNIVERSITY OF WASHINGTON

## Swerve Drive - Personal Design Project

**Design Process:**
Modeled in SolidWorks using advanced features such as wraps, sheet metal, weldments, and surface modeling. I analyzed component interfaces, refined clearances, and developed an exploded animation to illustrate motion and assembly. The project was completed with manufacturability and ease of assembly in mind.



**Overview:**
Designed and modeled a fully functional, manufacturable swerve drive assembly based on West Coast Products' Swerve X module. The drive system allows omnidirectional movement and incorporates precision tolerances suitable for real-world fabrication.



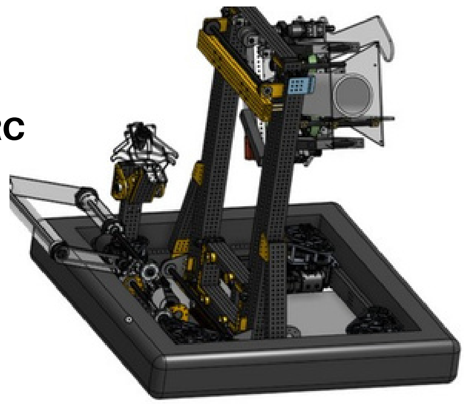

**Results:**
The final assembly included 43 unique parts with zero interferences and accurate mechanical motion. The swerve module demonstrated realistic operation and precise steering articulation across all degrees of freedom.

**Technical Highlights:**
Tools: SolidWorks (Surface, Sheet Metal, and Motion Study)
Skills: CAD modeling, tolerance analysis, reverse engineering, animation rendering
Methods: Parametric design, interference validation, manufacturability optimization

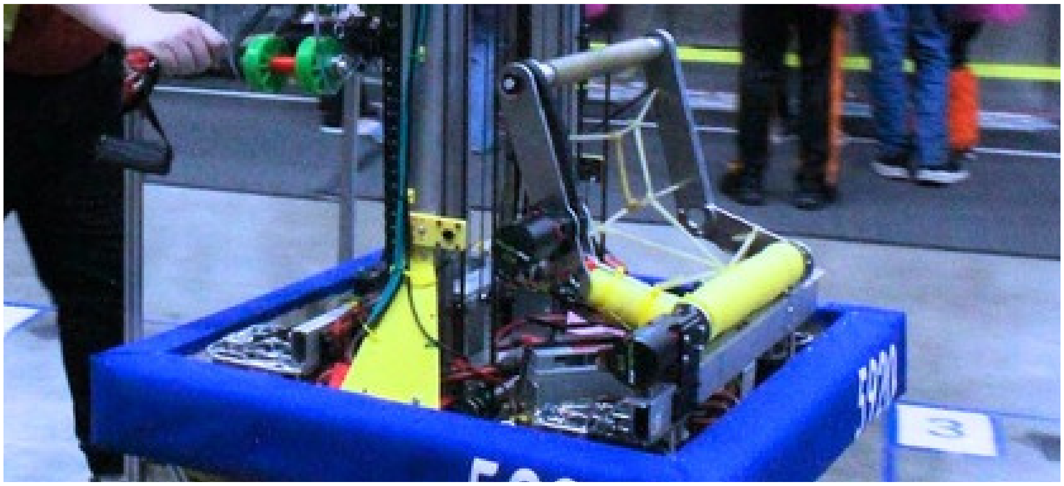
# CASEY FRANTZ

FUTURE MECHANICAL ENGINEER STUDYING AT THE UNIVERSITY OF WASHINGTON

## FIRST Robotics Competition - Mentorship



**Overview:**
**Served as a design mentor for a high school FIRST Robotics team during the FRC 2025 season. The robot featured a dual-stage cascading elevator, multi-object intake, and climbing mechanism for endgame scoring.**



**Design Process:**
**My focus was mentoring students through the CAD and design process for the intake and climb mechanisms. I introduced the team to CAD fundamentals, tolerance planning, and iterative prototyping. Together, we refined the slap-down intake for smoother actuation and improved game piece reliability.**


**Results:**
**The team overcame early mechanical issues and became one of the top five scorers in the Pacific Northwest regional competitions. The final robot was praised for its consistency, scoring efficiency, and durability across multiple matches.**

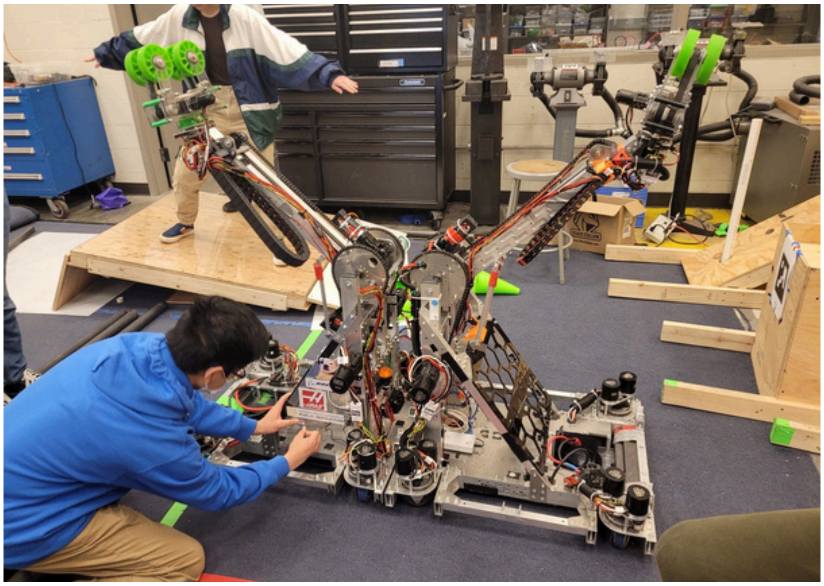
---

**Technical Highlights:**
**Tools: Onshape, SolidWorks**
**Skills: Mentorship, mechanical design, intake optimization, design for reliability**
**Methods: Iterative CAD refinement, student training, system integration**

# CASEY FRANTZ

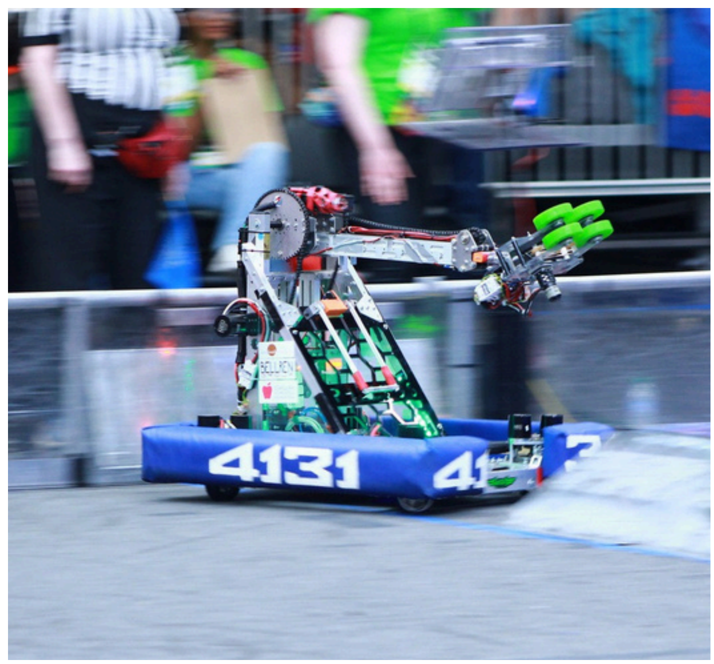
FUTURE MECHANICAL ENGINEER STUDYING AT THE UNIVERSITY OF WASHINGTON

## FIRST Robotics Competition - Mechanical Lead




**What?**

**Two fully functional competition robots for [FRC's 2023 game](). Both have a swerve drive base with a telescoping arm and two action intake which can pick up both cubes and cones securely to complete the game's objective**




**How?**

**Designed by our groups design subteams, it was sent off to me to lead the manufacturing of all aluminum, polycarbonate, and 3D printed parts. All parts were either manually milled, turned, or CNC routed with our machines.**

**Result.**

**Our robots performed outstandingly, leading us to the world championships, winning us engineering awards, and becoming top 40 of 3000 teams in the world in regard to placement. This was possible from fantastic integration of design, hardware, electronics, and software. Particularly, my impact was driving the robot and ensuring that the robot was entirely robust and reliable throughout multiple [high-contact competitions.]()**