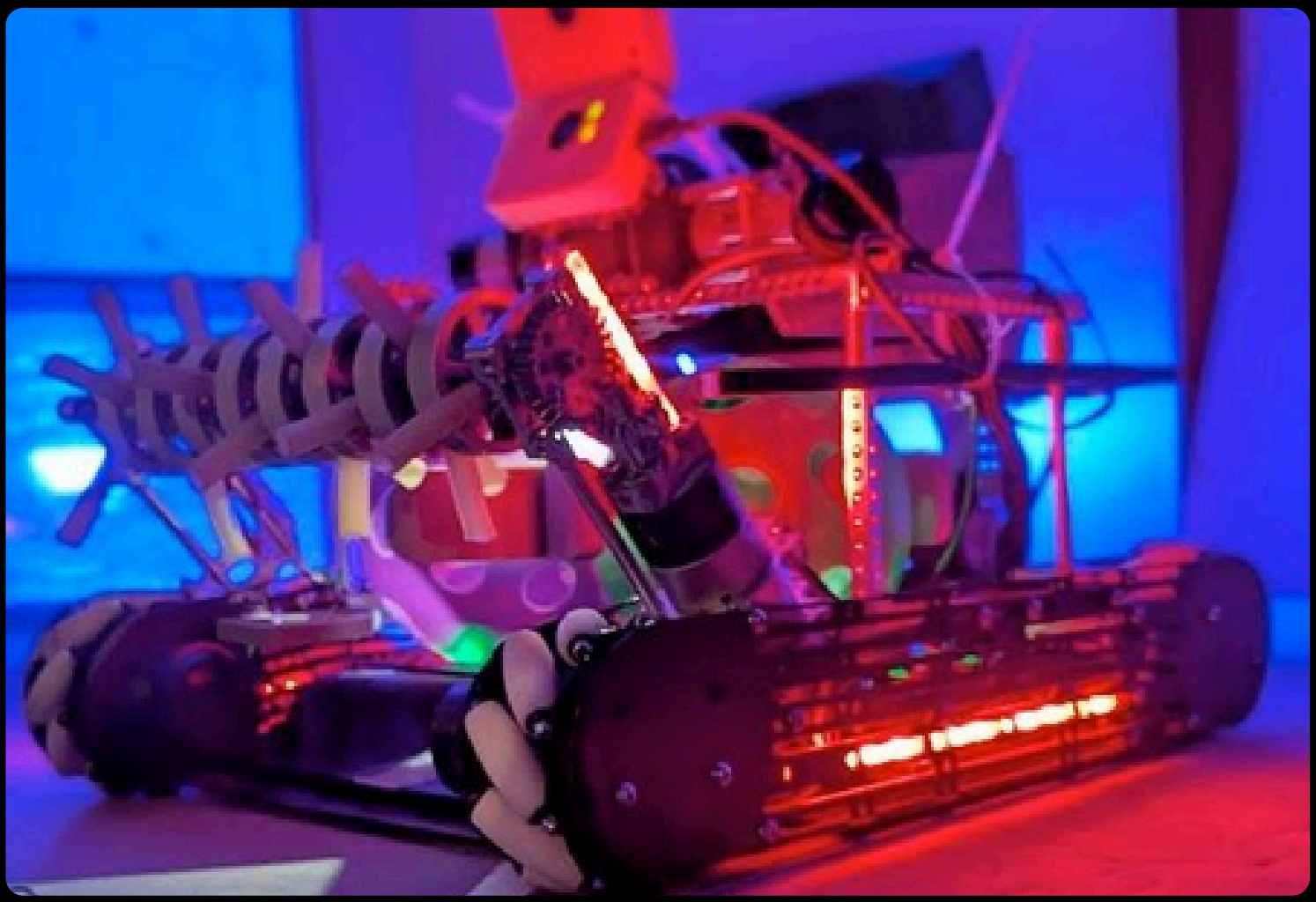
singultech 7034

EST. 2013 — WILTON, CONNECTICUT



ENGINEERING PORTFOLIO

10,548+ people • **311** teams • **1,931.5+** outreach hours • **29** initiatives

Team Member Skills & Contributions

Recruit from: FIRST-Exp STEM New-To-STEM Outreach



William O.

Captain | Design Lead

6th Year



Saara S.

Build | Outreach

3rd Year



Leo K.

Captain | Code Lead

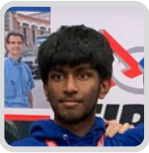
3rd Year



Vidit P.

Code

2nd Year



Anirudh N.

Build | Build Lead

6th Year



Sid A.

Code

2nd Year



Vivaan U.

Code | Outreach Lead

3rd Year



Daniel H.

Design

1st Year



Angela V.

Build | Outreach

4th Year



Sejal G.

Build | Outreach

1st Year



James R.

Programming

4th Year



John P.

Build | Outreach

1st Year



Henry L.

Outreach | Build

4thYear



Mrs. V

Teen Librarian

Coach



Anaya U.

Outreach | Build

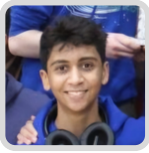
3rd Year



Dr. Danika

ASML Engineer

Mentor



Arav G.

Outreach | Build

3rd Year



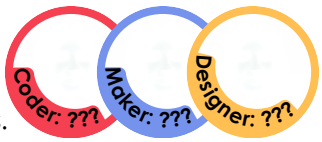
Dr. Kulon

Nuclear Medicine

Mentor

Illustrating Our Work

Tags identify specific contributions to show how we each achieved our personal goals.



Library Based



We are unique in that we are not a school-based or family-formed team—instead, we operate as a **library team.** Wilton Library Association provides us with space, resources, and opportunities for long-term sustainability, which you'll explore and **connect** with throughout our portfolio.

Team Plan

1) Off-Season Training: Conduct technical "bridge" training during the summer to ensure rookies are competition-ready before the season starts.

2) Guided Documentation: Pair veterans with rookies on all major tasks, requiring rookies to lead portfolio write-ups to demonstrate and solidify their comprehension.

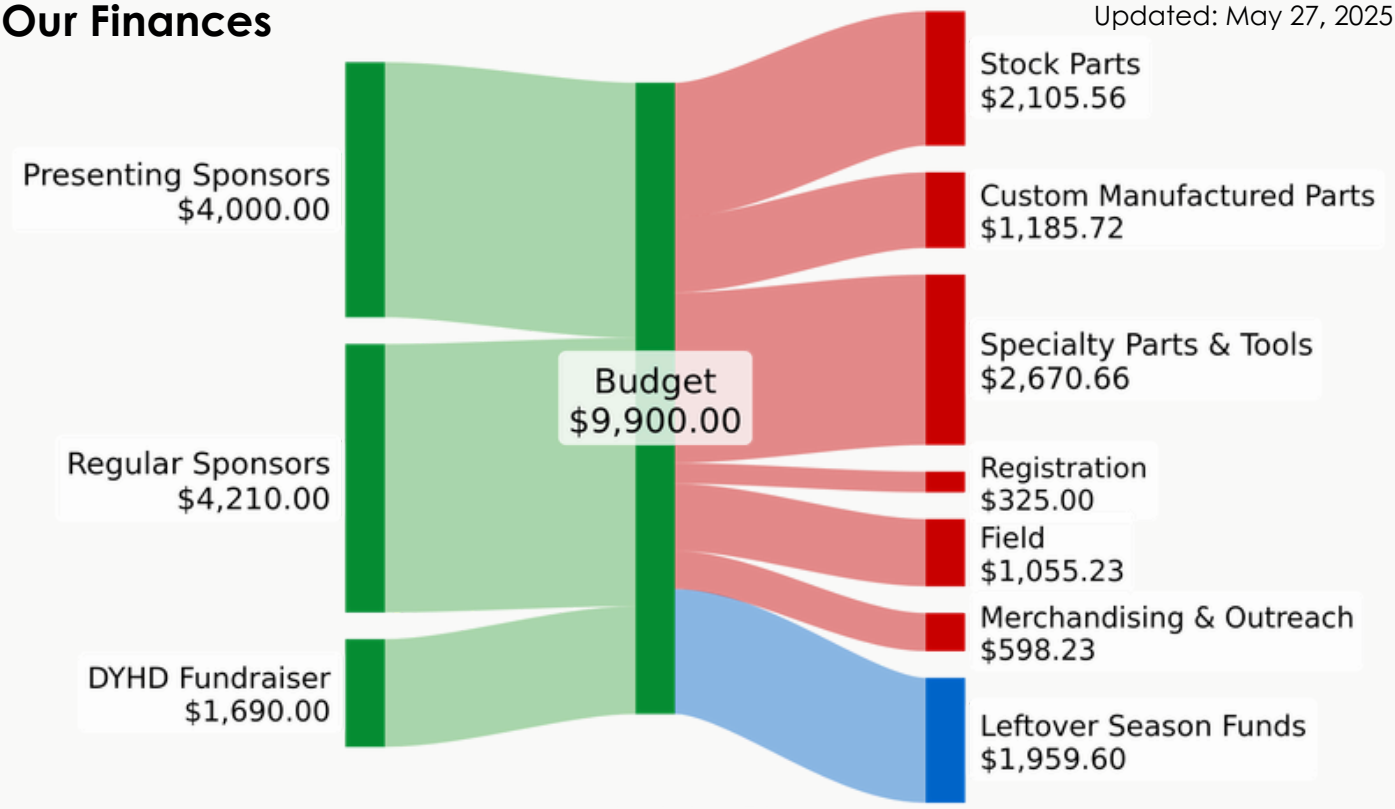
3) **Professional Networking**: Actively engage with local engineers to integrate industry-standard insights and diverse problem-solving methods.

4) **ASML Mentor Rotation**: Supplement permanent mentorship with a rotating guest-mentor program featuring engineers from ASML for specialized expertise.

5) Performance-Based Growth: Utilize a merit-based tracking system to assign increasingly complex tasks based on a member's proven track record and skill mastery.

Our Finances

Updated: May 27, 2025



Financial Sustainability Goals & Plan

1) Create marketing materials to send to & attract new sponsors
2) expand from our one presenting sponsor to a total of five
3) Program a finical database to better track our expenses

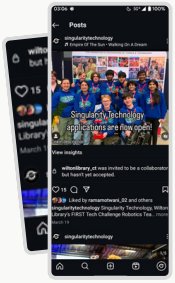
1) Marketing Materials



1 Partnership Packet



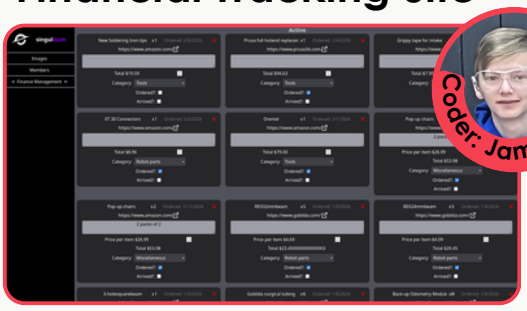
2 Flyers



10 Media Posts



3) Self-Programmed Financial Tracking Site



We developed **Singul-Dash**, a custom team management tool. This year, we added a finance page to process, record, and automatically categorize orders to **balance our spend**.

2) Our New Sponsors

ASML (new) · Kiwanis (new) · Yale (new) · MOODY'S (new)

Creative Marketing + Brand Sustainability Plan

To celebrate ten years of Singularity Technology, we began a brand makeover in the 2023–2024 season, transitioning from our green-blue 'Singularity Technology' theme to the black-white-purple 'Singultech' identity. Over the past two years, we gradually updated our **website and marketing materials**. This year, new **hoodies and banners** complete the transition. This stronger identity has helped us attract new sponsors and dramatically increase our community's interest.



New Hoodie Designs



impeded within the sleeves of our hoodies, are chips scan-able by phones that link to our team website.

NFC Tags



Pit Backdrop Banner

A Unique Mentorship Model

Our partnership with ASML goes beyond $2,000 per year in funding to include **2,000 hours of mentorship over three years** from a diverse group of engineers at their 3,000-employee local fab, providing broad expertise and long-term technical continuity for our team.

Student Recruitment

Student recruitment is driven by strong **school outreach** – such as presenting at the school science fair – **regular interest** through our website, email, and social media, and a sustainability pipeline through our **two FLL teams** that prepare middle school students to advance into FTC.

Fabrication Sustainability

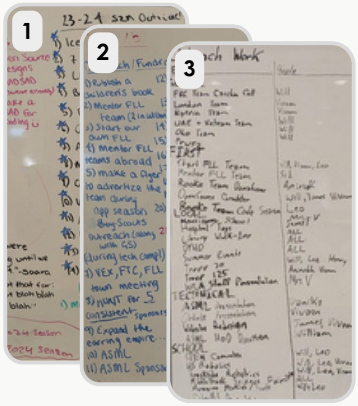
Custom parts, usually one-fifth of our budget, spiked due to **tariffs**. After consulting CT's Chief Manufacturing Officer, we used the CONNEX database to **source parts locally.** We plan to continue this approach and are working with the state to **help other teams** access local manufacturers.



Outreach Plan & Introduction

Plan:

In pre-season, we **(1)** listed past outreach events and **(2)** added new ones for the '25-'26 season. Once the season started, **(3)** we sorted these opportunities into 5 communities & delegated them to team members.



4 Primary Outreach Communities

- FIRST
- Technical
- Local
- School

Stats:

Impact: **10,548+ Individuals & 311 teams**

Initiatives: **29**

Cumulative Hours: **1,931.5+**

FLL STATES SUCCESS

19 People • 460 Work-hours

The two FLL teams we started and mentor, **Allied Algorithms** and **Singularity Technology Juniors**, had an outstanding performance at the Connecticut State FLL Championships. Allied Algorithms **won the state championship.** Singularity Technology Juniors earned the **Motivate Award.** The success represents months of Will, Leo, Vivaan, Anaya, & Sid mentoring the two teams in robot build & their innovation projects: artifact preservation chambers. **Our FLL teams proudly represent the future of our FTC team.**

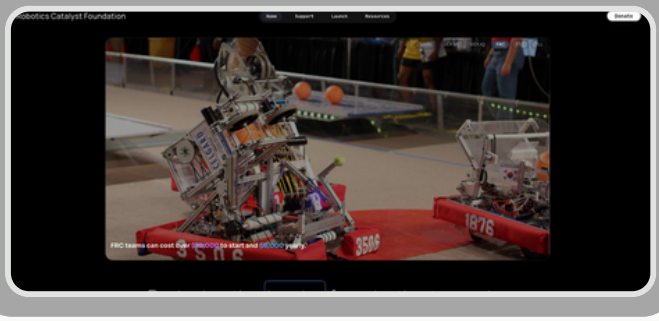


Robotics Catalyst Foundation

~80 People • 140 Work-hours

This summer, we registered a nonprofit, the Robotics Catalyst Foundation as a **501(c)(3) organization** to serve as the central treasury/hub for new robotics teams in our town. So far, we have **raised over $9,000** to support local FLL, FTC, VEX, and NHRL teams. To scale our impact, beyond our town's border, we are developing a global FIRST database to connect mentors and students with teams.





Setting-up 6 New FLL Teams

37 People • 34 Work-hours

Following our participation in the 2025 FTC World Championships and our recent success in FLL, **interest in FIRST programs in our town has grown exponentially**. We are currently working with our local middle school to establish **six new FLL teams,** supported by long-term sustainability plans that include mentorship from high school students. We have also begun providing pre-season mentorship to these middle schoolers to ensure they are well prepared to **compete in the 2026-2027 season.**





Open-Source Code & CAD

3267 People • 297 teams • 40 Work-hours

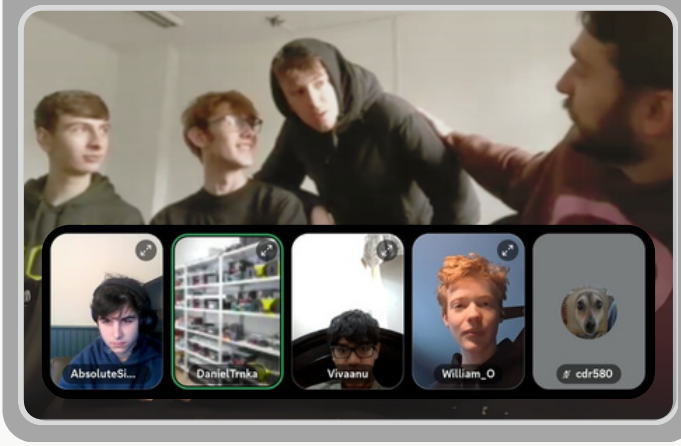
We developed and maintained 3 opensource projects on our website for the FIRST community to freely download and improve: 1) a Java class enabling run-to-position functionality in servos similar to stepper-motors using analog encoders, 2) an FTC game-pad controller Java class providing a useful interface for rookie teams, and 3) our 2x Servo to JST-PH connector PCB board, designed in KiCAD, to convert analog servo inputs into I2C signals for precise encoder control. Since the start of our season, over 283 teams from 21 countries worldwide have downloaded these projects from our website.



Czech FRC Team 9598

17 People • 28 Work-hours

With our connections in the **Czech Republic** (Czechia), we connected with **FRC team 9598 RobUL.** We have set up and called them in video meetings to share each other's programs, challenges, & **FIRST experiences.** Since they are a relatively new team, we regularly assist them with their C++ and Java coding needs.



Setting-up India FTC Team

2 Members • 18 Work-hours

We are working with a group of students in India to start an FTC Team in Delhi using our expertise. We are assisting them with fundraising and training and are on track to register them for the '26-27' season.



Alumni Visitations

2 Members • 6 Work-hours

Two alumni from our robotics program, Aarushi and Anant, **attended our meetings** during their college winter break. We presented our robot to them, and they offered advice and tips to succeed at our upcoming competitions.

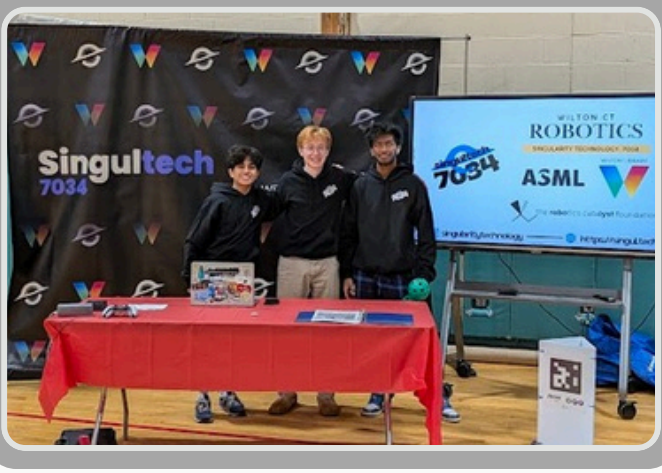
Lessons Learned & Improving Future Events

Our outreach in the FIRST community taught us the importance of **aggregating and developing** technical talent by sharing and learning it from both younger and older students, locally and internationally. Our service taught us that collaboration, especially when applied to STEM, can **transcend age gaps & borders.**

Local Outreach - REACH

Community Open-House
230 People • 12 Work-hours

Following our highlight achievement competing at the FTC 2025 World Championships, we ran an open-house presentation at our local community center to show off previous robots, make ourselves better known in the community, recruit potential teammates and gauge interest for robotics in our town.



Summer Camp Programs
75 Students • 72 Work-hours

Over the summer, we ran a camp with 3 sessions in which we educate about many **essential STEAM concepts** through interactive projects such as rubber band cars, and rube goldberg machines, through which we have **recruited team members.**



Destroy Your Hard Drive
67 People • 33 Work-hours

Each year, we host a Destroy Your Hard Drive event, safely destroying drives to **protect data.** We showcase our robot, engage the community, and **refurbish computers** for donation.



Library Presentations
~56 People • 8 Work-hours

Our library workspace has large windows, showcasing our work to passersby. During biweekly meetings, we **explain FIRST** and our robot to curious students, teachers, and parents. Additionally we held 2 open-houses for patzrons to come in and ask questions.



Lessons Learned & Improving Future Events

Through our local community outreach we learned about the many **parallels of robotics** and FIRST values that exist around us. Problem solving, patience, collaboration, creativity, and leadership **manifested themselves** in all our events, giving us hope that our future STEM careers can have local root impacts too.

School Outreach Pt. 1 - REACH

Extracurriculars

Began VEX Robot Team
8 Students • 105 Work-hours

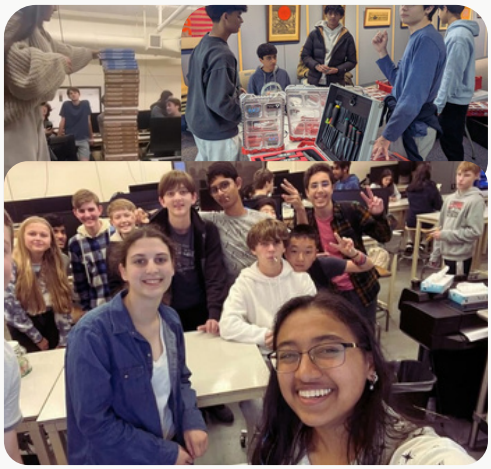
- Founded robotics club
- Secured startup funds
- Lead weekly meetings

Engineering Club
41 Students • 76 Work-hours

- Lead engineering club
- Teach design principles
- Instruct fabrication tools

Science Olympiad
5 Students • 24 Work-hours

- Mentored students on 'Robot Tour' Challenge
- Helped win state champs.



Service



Managed HS Equipment
~160 Students • 193 Work-hours

- Maintained fabrication
- equipment
- Secured $7k grant

Updated Laptops
189 Teachers • 126 Work-hours

- updated 1,200 chrome books in preperation for SAT testing
- Got 10 extra volunteers helping

Engraved Laptops
260 Teachers • 87 Work-hours

- Engraved 980 teacher laptops
- Saved district thousands of $
- Raised $1,300 for clubs

Presentations

School Sci. Fair
~300 People • 46 Work-hours

- Judged science fair
- Presented to 300+ attendees
- Mentored state-fair champions

5th Graders
~180 Students • 34 Work-hours

- Taught 180 students
- Presented engineering concepts
- Supported CS curriculum

School Festival
~260 people • 13 Work-hours

- Showcased robot at festival
- Gave presentation on mechs.
- Engaged students with demos



School Outreach Pt. 2 & Technical Outreach Pt. 1
REACH & CONNECT

singultech

STEM, Robotics, AI Committees

3,788 Students, 193 Work-hours

Through our ongoing role on the school's **Robotics Committee**, we…

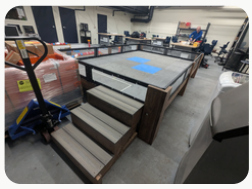
- Secured and budgeted **$80,000 in grants for the robotics lab**
- Designed the lab layout using REVIT
- Built lab furniture, including field risers
- Developed curriculum for **Robotics I & II classes**

Through our ongoing role on the school's **AI Committee**, we…

- Instructed 215 K-12 Teachers on integrating AI into their curriculum
- Mentored students in the presidential AI challenge.

Through our ongoing role on the school's **STEM Committee,** we…

- Re-structured curriculum for four engineering courses, doubling enrollment by making them more accessible
- Advocated for expanded *FIRST* programs in our district to the BOE.






Lessons Learned & Improving Future Events

Our outreach work showed us the power of embedding **STEM and FIRST** into our curriculum, service, and extracurriculars for **lasting impact**. By securing grants, writing proposals, and creating school robotics courses, we've created **opportunities** that will continue to grow and benefit students **long after we've graduated**.

Technical Outreach Starts Here

Actively Engaging with Engineering Community



FAB 25

60+ Connections • 20 Hours
Prague, Czechia

We attended the **"Bridge the Gap,"** FAB25 conference uniting **1,000+ participants** from over **50 countries** to share ideas, skills, and tools for sustainable, open-source making & robotics.



IEEE Robotics School

2 People • 60 Hours
Prague, Czechia

Our captains attended this summer-school focusing on building & programming drones for disaster scenarios. They collaborated with **224 PhD candidates** from over **40 countries** @Czech's top school



Tri-State Engineering

40+ Connections • 5 Hours
White-Plains, New York

We visited the tri-state engineering fair, where we learned about local and post high-school **engineering opportunities.** We also created many connections with engineers.

Interviewing & Connecting with Engineers

ASML
Brian Amero

Mr. Amero is the Community, Employee Engagement Specialist at Wilton's ASML branch, with whom we worked with to design **new labs & curriculum** for our local schools.

Yale
Drs. Spencer & Zaveri

We interviewed these two **neuroscience-robotics professors** and worked with them in developing **autonomous navigation algorithms** inspired by how bat's brains map the world.

CT State
Paul Lavoie

Connecticut is the only state with a manufacturing department. We interviewed **Chief Manufacturing Officer** Mr. Lavoie about the impact of tariffs on robotics programs.

Oracle
Rajesh Uttamchandani

Mr. Uttamchandani, is a **project manager** at Oracle, a computer technology company. We discussed how to improve our design process, tools for **team management**, and efficient prototyping.

.



From left: Cathy Ma, Brian Amero, Dennis Spencer, Hitten Zaveri, Paul Lavoie, Rajesh Uttamchandani

Presenting to Engineers

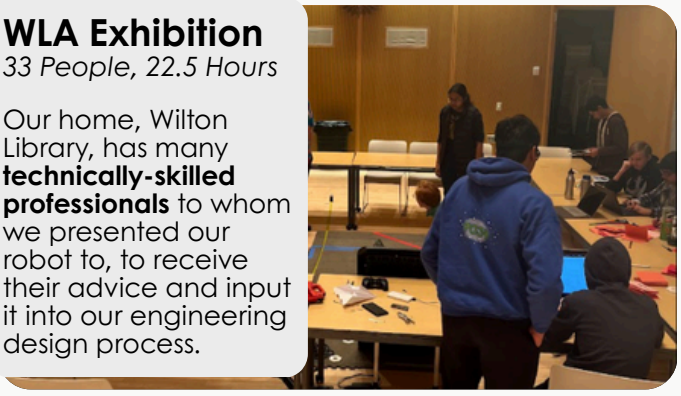
Website
1,368 People, 96 Hours

Through our interviews we learned the value of **providing a user-centered approach**, a strategy we applied in making our own website, this year, which includes resources for teams.



WLA Exhibition
33 People, 22.5 Hours

Our home, Wilton Library, has many **technically-skilled professionals** to whom we presented our robot to, to receive their advice and input it into our engineering design process.



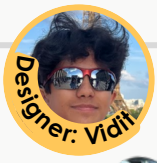
Lessons Learned & Improving Future Events

Our technical outreach with the engineering community taught us about the many parallels between the the engineering design process and our outreach: The cycle of **Observing** in conferences and factories, **researching** through interviews, and **presenting** our learnings, were **repeated many times** this season.

Prototype

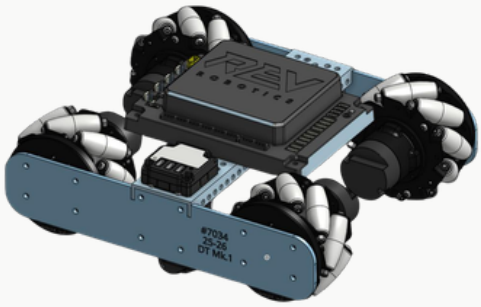


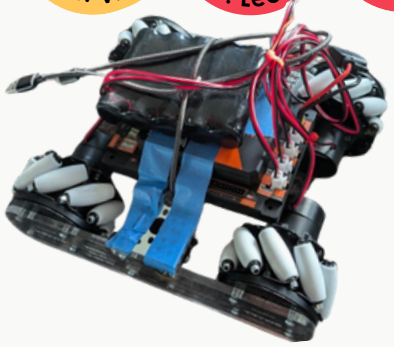












During the pre-season, we taught our **rookie** team-mates the **fundamentals** of CAD, programming, and build by creating this prototype drive-train. Additionally, we were able to test our new SWYFT wheels, which are lightweight with motors inside the wheel hubs, encoders, and 60fps camera to locate based on april-tags.

Drivetrain Goals

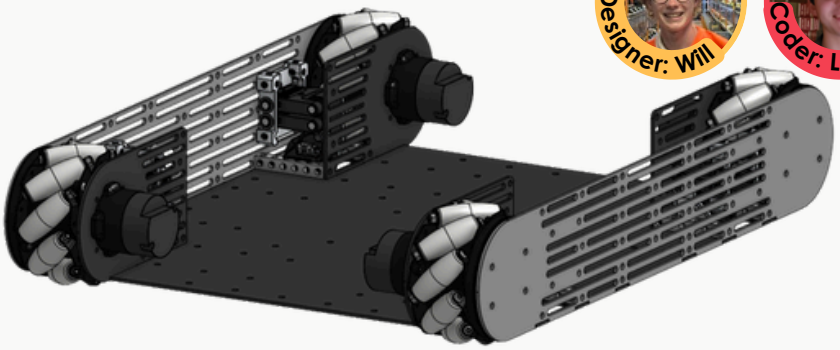
Last season, our robot **weighed over 30lbs** with an extremely top-heavy mechanism, making it prone to tipping at high speeds. This year, we aimed to keep our robot **modular** while designing a low center of gravity with stiff, yet extremely **lightweight** materials to ensure a much more **agile** and stable driving experience.

Carbon Fiber Drivetrain

Modularity: Retained our proven slotted side-plate design for easy, universal mechanism mounting.
Lightweight Durability: Utilized a carbon fiber paneled frame, achieving a robust structure weighing under 1 lb.
Integrated Drive: Switched to SWYFT hub-motor wheels, eliminating complex belts to save weight and hit speeds of 7 ft/sec.

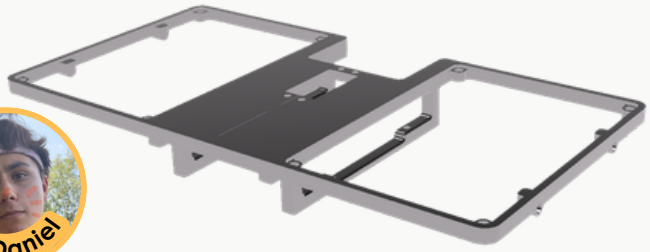






Base Layer - Wire Housing





An **elevated floor** above the baseplate supports artifacts and integrates mechanisms while keeping wiring concealed and snag-free. Lateral **access panels** provide quick entry to the control and expansion hubs for maintenance.

Elegant

- carbon fiber paneling allows for minimalism
- concealed internal wiring prevents wire snags
- integrated hub motors eliminate need for belts

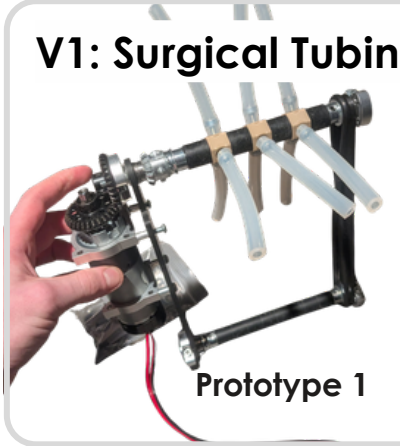
Efficient

- High Power-to-Weight ratio allows for speed
- low center of gravity allows for maneuverability
- multi-purpose layer holds everything together

Easy to Maintain

- Lateral access panels means control and expansion hubs are readily accessible
- Slotted side-plates allow for universal modular mechanism mounting

V1: Surgical Tubing Top & Bottom

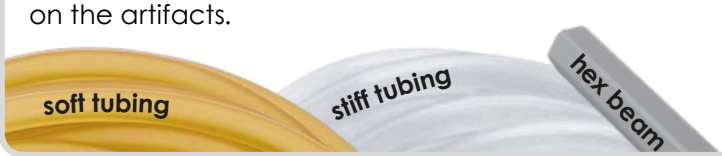


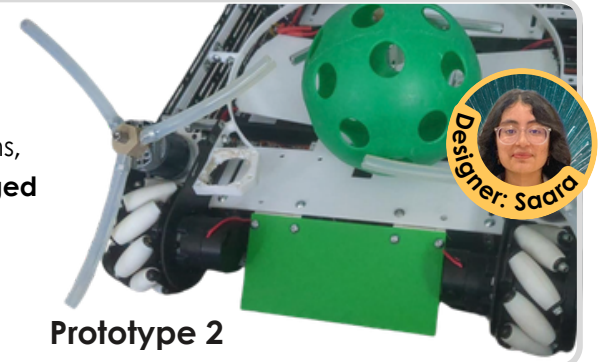
We began the season by building a surgical tubing intake with a **bottom counter-roller**, testing various thicknesses for optimal compliance. However, the tubing spokes consistently snagged on artifact holes, causing our sorting mechanism to jam during operation.



V2: Side-Mounted Surgical Tubing

We then tried side-mounted surgical tubing, but even the stiffest options were **too compliant**. We switched to rigid metal hex-beams, which solved the flexibility issue, but the **three-spoke design snagged** on the artifacts.



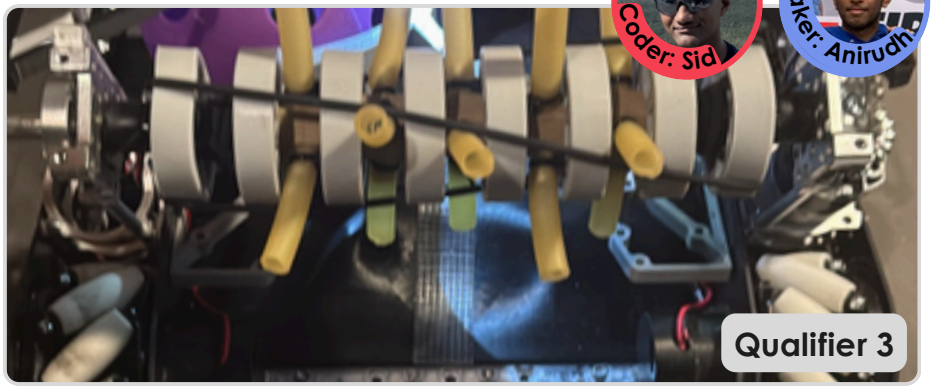


V3: Semi-Stiff Rubber Wheel 3D-print



V3 used **95A TPU** to balance spoke rigidity with semi-compliance. While we refined the **30-degree internal pattern** for better intake, the material proved too stiff to achieve the desired performance.

V1+V2+V3 = V4



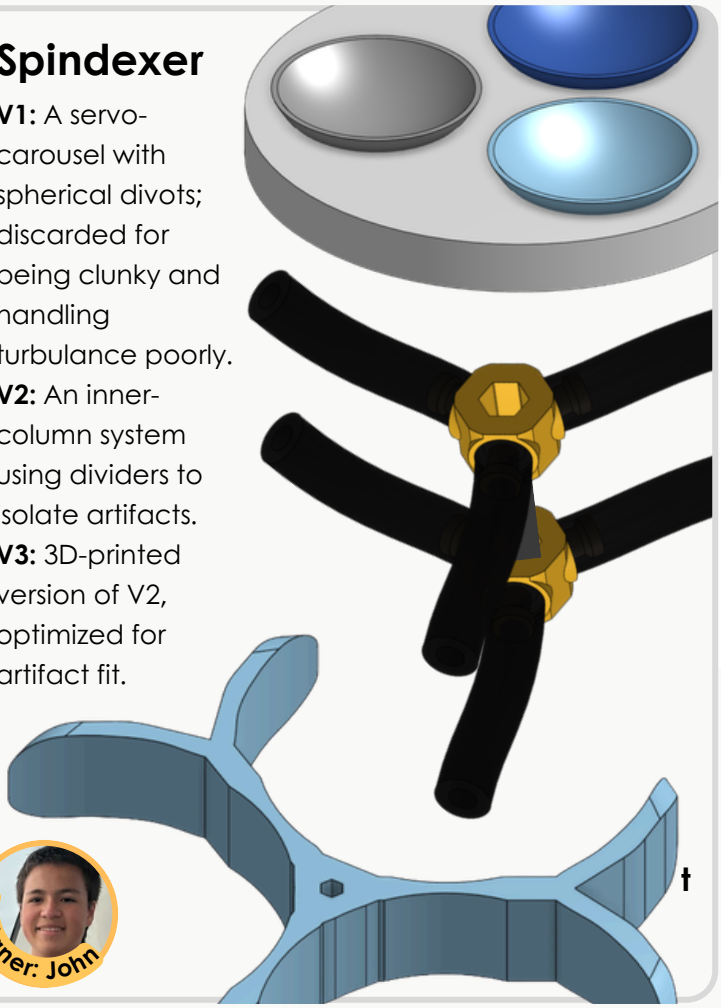
Our latest iteration combines V1's **top-roller** frame structure, V2's variety of **surgical tubing** materials, and smaller versions of V3's **wheel** (grey) on a **2,000rpm motor** and newly designed base ramp.

Lessons Learned

Innovation isn't an "aha" moment, bur rather a scavenger hunt. By stripping the **best parts from our failures** and stitching them together, we realized the winning design wasn't a brand-new invention; it was just a smarter remix of everything we'd already tried.

Spindexer

V1: A servo-carousel with spherical divots; discarded for being clunky and handling turbulance poorly.
V2: An inner-column system using dividers to isolate artifacts.
V3: 3D-printed version of V2, optimized for artifact fit.



Color Sensor & RGB Strip

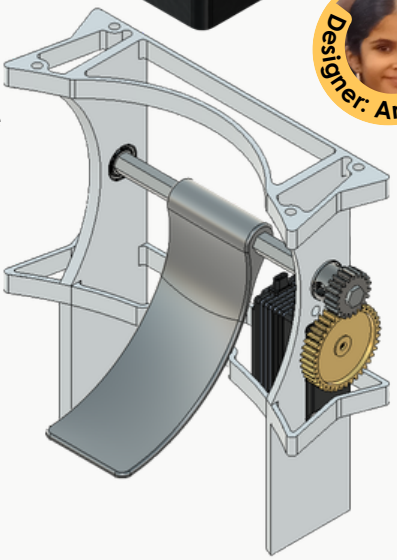


We use a color sensor and RGB light strip to detect the artifact's color upon entry. By pulsing between **green and purple wavelengths** instead of just white light, we ensure detection of the correct color even in poor light.

Artifact Lifter

We transitioned from a dual-servo four-bar lifter to a geared 'scoop' design to overcome height and power limitations. While the original design managed only 14mm of lift, the new geared system provides the force necessary to handle full-sized artifacts and reliably feed them into the launcher.

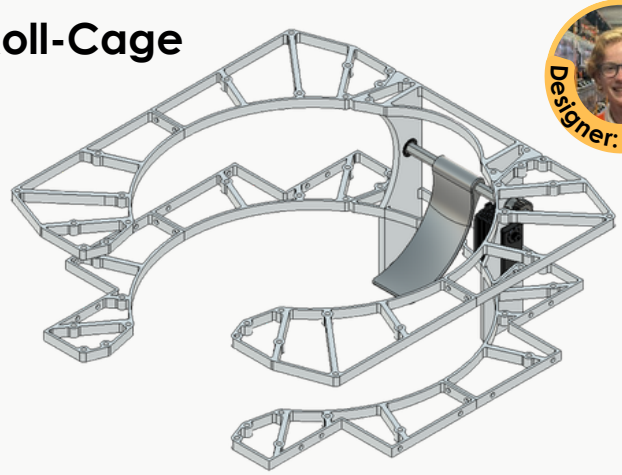






Roll-Cage



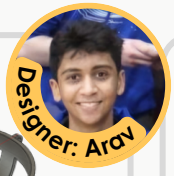


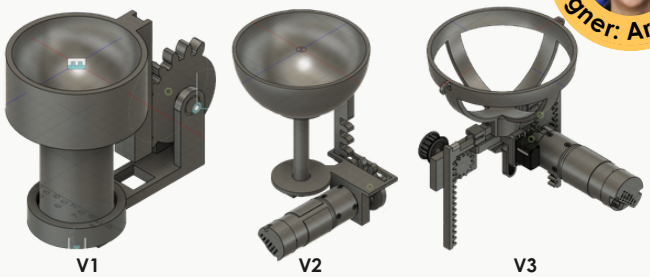
Elegant: Minimalist frame ensures maximum internal visibility for inspections and scoring.
Efficient: Optimized wireframe geometry achieves a peak strength-to-weight ratio.
Easy to Maintain: 8-piece assembly using only 2 unique files; M4 threaded inserts enable rapid component replacement.

Lessons Learned

Coordinating the **multi-designer development** of central robot components underscored the importance of communicating precise tolerances to ensure **cohesive assembly** and functional integration.

Spring Slingshot

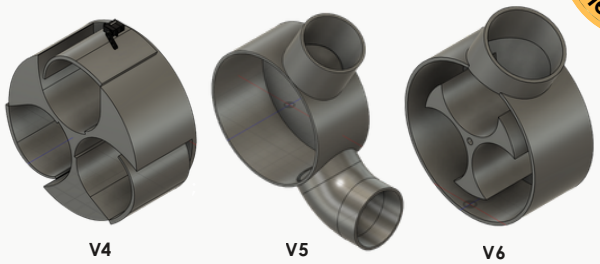




This motor-driven system uses **central springs** and gears to retract the launcher for high-tension firing. However, inconsistent spring force during the drawback caused the assembly to twist and **jam vertically.**

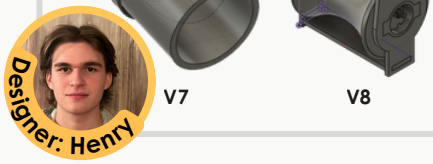
Circular Cyclone





This **centrifugal design** uses a high-velocity artifact casing and a servo-controlled door to time each release. However, the hardware's speed and accuracy limits couldn't meet the **millisecond precision** required, resulting in inconsistent firing.

Fast Flywheel



This flywheel system uses momentum transfer to bypass the need for perfect timing. We tested various rubbers to ensure consistent, **spin-less**, controlled shots.

Risk Considerations

Design	Primary Risk	Impact
SS	Mech. Fatigue	high tension cause by 3D-print warp
CC	Timing Latency	Hardware limits made milisdeocn presicion impossible
FF	Surface Friction	success depends enterily on cosnsitent rubber

We realized that **mechanical complexity** (slingshot) and s**oftware complexity (**cyclone) were our biggest points of failure. The flywheel won because it shifted risk from "complex movement" to "**material choice**," which was much easier to control and iterate on.

Outcome version





Limelight used extensively for TeleOp and Auto automatons.

Reliability / Future Improvements

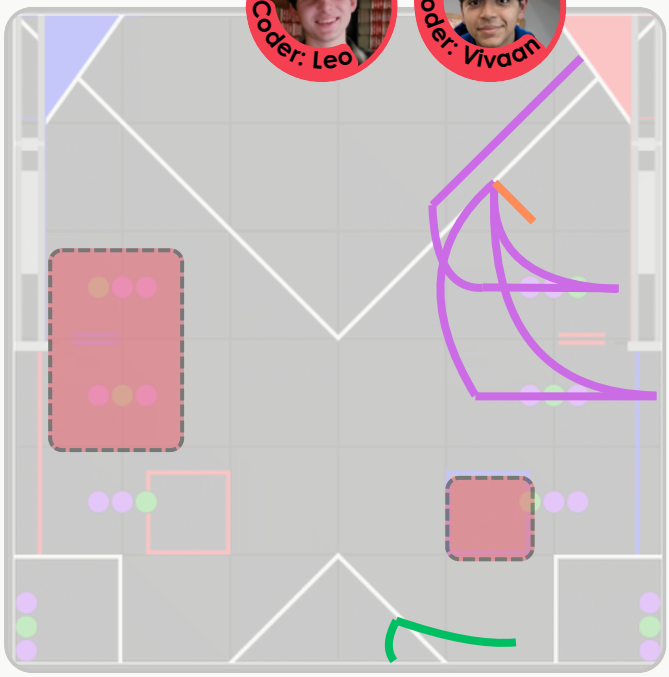
Our current design only adjusts flywheel velocity. Because the launcher **naturally imparts spin**, artifacts often bounce out when hitting the hoop at a fixed 60-degree angle. Implementing an adjustable-tilt hood is our next priority; by entry-angle tuning, we can ensure projectiles enter the hoop **perpendicularly**, neutralizing the impact of spin and **maximizing reliability.** We intend to achieve this by the state competition.

Limelight



We utlize our limelight extensvely – that's why we put it on a servo to **extend its FOV.** In its upward position we use it to scan the localization & MOTIF **AprilTags**. Meanwhile, in the downward position we scan for nearby artifacts to pick up based on our **sorter algorithm's** choice.

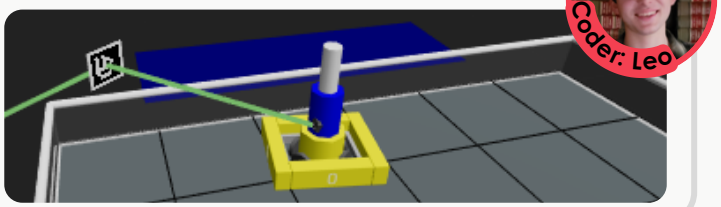
Navigation



- **9-Ball (Near-Side) & 6-Ball (Far-Side) Auto:** High-consistency path with integrated color sorting by scanning motif AprilTag
- **Hybrid Localization:** Continuous tracking using Limelight + Odometry to double-check and correct for drift or offsets
- **Smart Ranking Point (RP) Logic:** Auto-clears shooting zone at T−2s to guarantee mobility RP.
- **No-Go Zones:** Software-defined exclusion areas for gates and endgame parking spots.

Automated Synergistic Sub-Systems

- **Auto-Intake:** Limelight-assisted spline and path correction to "lock on" to nearest artifact of robot's desired color; driver can intake artifacts even while blind.
- **Active Defense Recovery:** Detects acceleration anomalies; triggers "shake and spin" maneuvers to get out of pins from other robots
- **Vision-Locked Launch:** Fires automatically when ***Zone, Velocity, and Yaw*** align via Limelight. Scores on average 24-30 artifacts in TeleOP.
- **Automatic Endgame:** Pre-programmed sequence for last-second parking.



Robot Motif Intelligence

- **Auto-Sorting:** Real-time color sensor filtering, automatically arranges sorter's artifacts to shoot in correct order to maximize motif points
- **Smart Ramp:** 2nd driver tells robot number of balls in scored ramp so robot can automatically prep sorter with correct color artifact for motifs

Driver Feedback



- **LED Telemetry:**
  - **Rainbow:** Launching active.
  - **Green/Purple:** Signals driver which color ball to target next.
  - **Yellow Flash:** Confirms artifact was picked up and scanned by color sensor.
- **Haptics**: PS5 Controllers buzz when artifact has been intaked or launched; allows blind driving.
- **Manual Overrides:** 2nd driver has manual overrides for every automated feature.

PLAYING FULL GAMES WHILE BLINDED

Our extensive limelight use, navigation algorithms, sub-system synergy, robot motif intelligence, and driver feedback sum to full-game blind autonomy.