3583

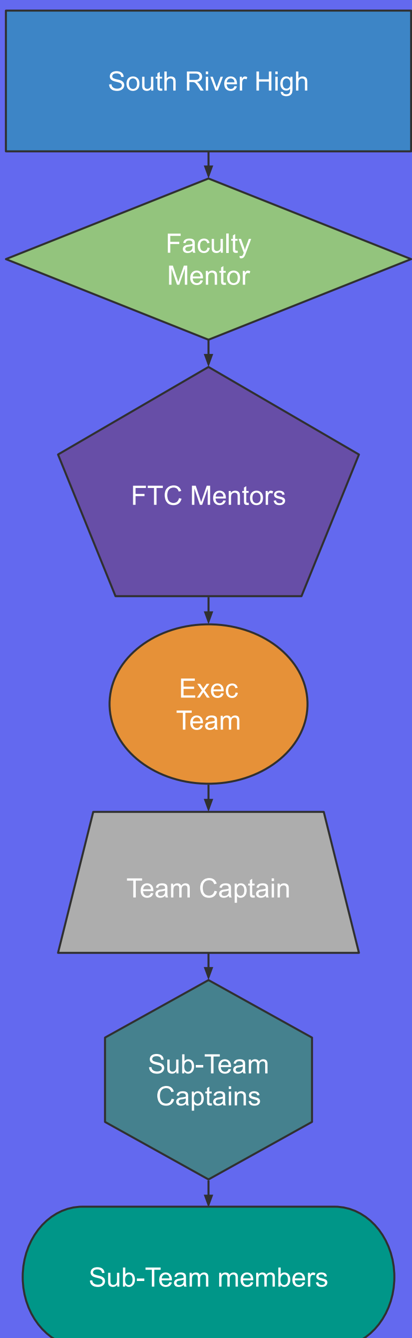
Cybirds Team Portfolio

24-25

Table of Contents

About Us

The 3583 Cybirds are a robotics team native to South River High School, located in Edgewater, Maryland. Since 2009, we have been applying STEM skills in a fun and engaging way, providing roles for individuals with diverse interests. As a STEM magnet high school, we have students coming from throughout the county to participate in the STEM programs and apply their knowledge to FTC. Robotics is a place where people of all grades can come together to socialize while learning about values like Gracious Professionalism and Coopertition, and how these values make robotics more enjoyable.



How Our Team Is Organized

Cybirds 3583 has 14 active members this season. That's a bit more than recent seasons and we seem to have passed the "Covid" slump of low recruits.

We have a traditional structure to our team and we work within a program that hosts two other FIRST® Tech Challenge teams. There is also an FRC team in the same space, but we are independent of them for nearly everything, including fundraising.

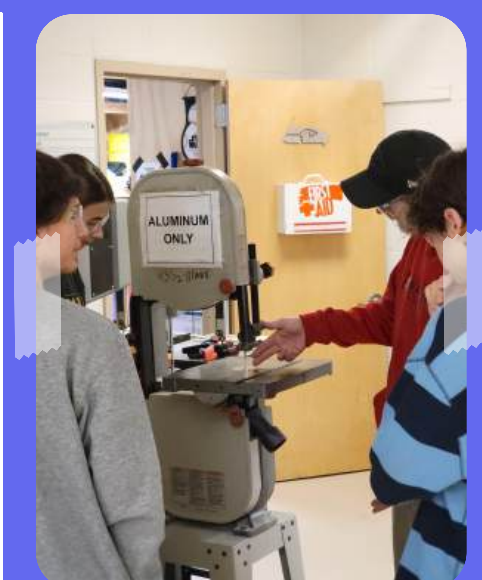
The FTC Power Robotics program at SRHS has a branch of central student leadership known as the Executive Team. These three positions help to facilitate the 3 FTC teams as a whole. We have a CEO, COO, and a Chief Team Coordinator. Together, they run a lot. However, all else falls on the 3 Team Captains that have autonomy over their own teams.

Teams are then divided into 3 sub-teams, Build, Programming, and Business. Team Captains name their sub-team captains and this level is known as the Leadership Team. This traditional structure helps us to better group members by interest, to offer more focused and in-depth training sessions, and to better approximate what a professional workforce team would resemble.

Skills Training

After our mandatory shop safety training for all, a big part of the season this year was the expansion of real training in CAD for several team members. A lot of time was spent with both mentors and peers teaching and guiding as members designed unique creations for use on this season's robot. The intake bucket was just one of these creations.

Another area of growth was that the team opted to use an increased amount of fabricated materials, primarily using 3D printers to bring ideas to reality. We also had access to a CNC router, but the team didn't really find much use for that as of yet. Perhaps next year.



Mentor teaching shop safety at the start of the season

Meet the Team

Mitchell (Team Captain)

Sub-Team:
Business/Build

Years With FTC: 5

Goal For This Year: Educate the newer members about the aspects of STEM.

Aimilios

Sub-Team:
Build

Years With FTC: 1

Goal For This Year: Help team as much as possible and win an award.

Alex

Sub-Team:
Build

Years With FTC: 3

Goal For This Year:
Work well as a team.

Amelia

Sub-Team:
Build

Years With FTC: 2

Goal For This Year: Build a robot that functions with none or barely any flaws.

Elsa (CTC)

Sub-Team:
Business

Years With FTC: 3

Goal For This Year:
Earn an award.

Finnegan

Sub-Team:
Programming/Build

Years With FTC: 1

Goal For This Year:
To win and grow my skills.

Jack

Sub-Team:
Build

Years With FTC: 1

Goal For This Year: Have fun, bond with others and win.

James

Sub-Team:
Business

Years With FTC: 1

Goal For This Year: Apply STEM principles in a real-world setting.

Meet the Team

Jacob

Sub-Team:
Programming

Years With FTC: 3

Goal For This Year: Win and succeed by having fun.

Leo

Sub-Team:
Build

Years With FTC: 3

Goal For This Year: Perform well and bond with others.

Matt TC

Sub-Team:
Build

Years With FTC: 2

Goal For This Year:
Go to worlds

Rory

Sub-Team:
Business

Years With FTC: 2

Goal For This Year: Grow a deeper sense of unity with other teams.

Ryan

Sub-Team:
Programming/Business

Years With FTC: 2

Goal For This Year:
Perform well as a team while exemplifying FIRST

Zayan

Sub-Team:
Build

Years With FTC: 3

Goal For This Year: Learn more teamwork and communication skills.

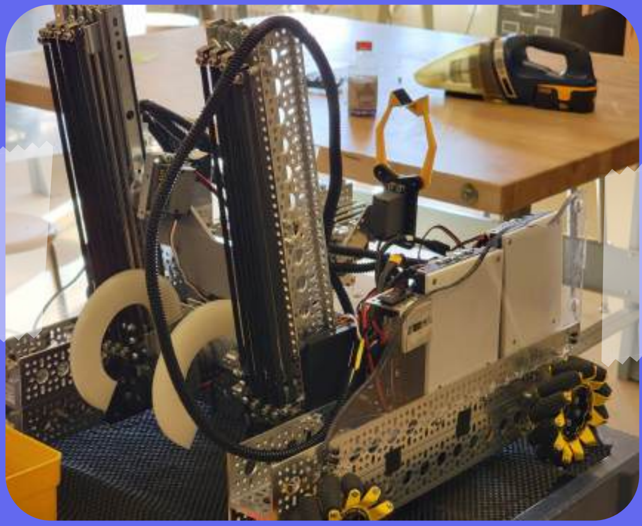
GO CYBIRDS!

Robot Overview

Our bot before last competition...

Our robot design consists of a system that favors simplicity in all subsystems, in the software, hardware, and strategy. For overall robot design, we use a claw attached to a horizontal linear slide in order to reach the samples in the submersible. The linear slide retracts, allowing the claw to then place a sample into our bucket, which is 3D-printed. This bucket is attached to a servo on a vertical linear slide in order to reach the top basket, our main method of scoring.

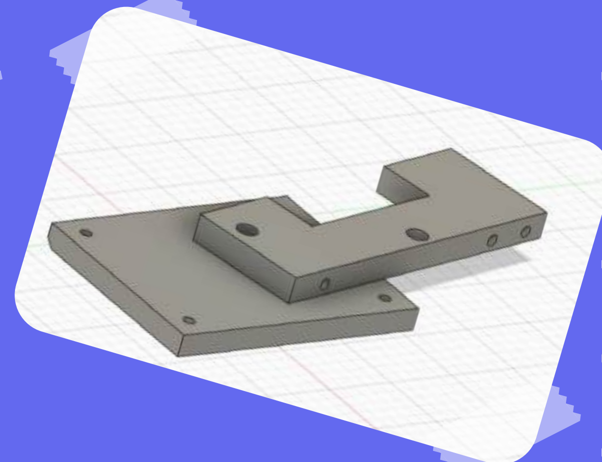
Additionally, our robot has hooks placed at the base of the linear slides in order to achieve a consistent hang during end-game, securing more points for our alliance. Tele-op uses straightforward controls that offer more maneuverability, while keeping operation simple. Inspiration for controls has been taken from well-known video games, offering familiarity to our drivers. The autonomous program runs on the motor encoders to ensure precision, scoring a preloaded sample and two samples from the spike marks before driving to a level one ascent.



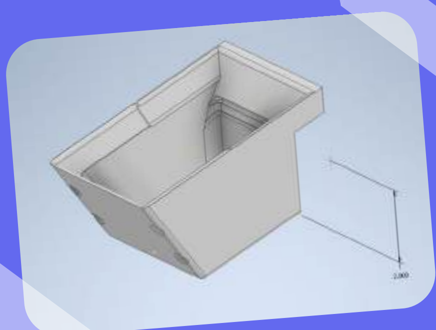
...and now!

Design & Planning

At the start of the season, we spent a lot of time brainstorming, writing down every idea, good or bad. We then made concept sketches and filtered these ideas through decision matrices in order to determine what aspects to keep and what to abandon. Some of the main factors we took into account were complexity, cost, and effectiveness. Through this, we narrowed down our design to a few key systems, which we voted on to see what we would eventually go with.

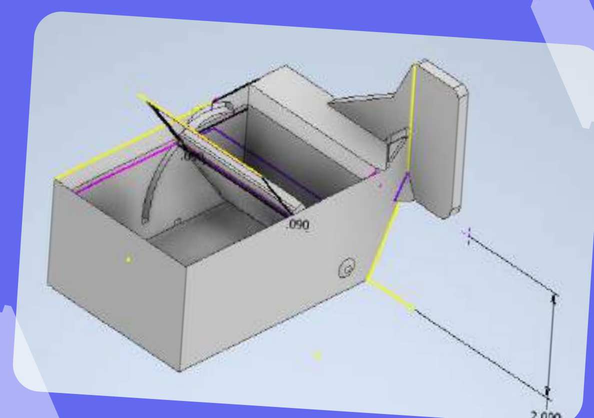


Custom mounting plate for linear slides



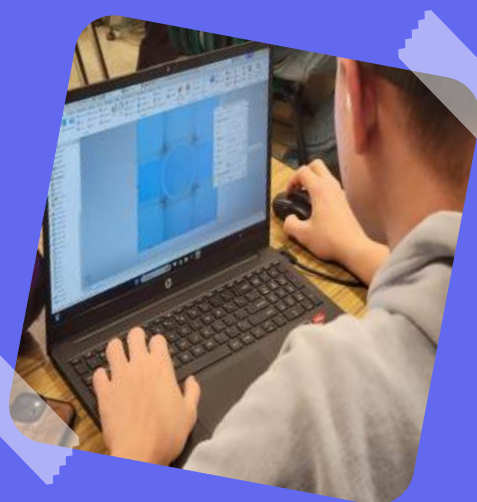
Earlier model of our bucket

As we got a better idea of what the robot would look like, we made more detailed sketches and started with CAD models. These are good for making custom parts we cannot buy, such as our bucket, vertical slide mounts, claw mount and the grips on the claws. These custom parts are unique to us and can't be found anywhere else in FIRST®.



Current model of bucket

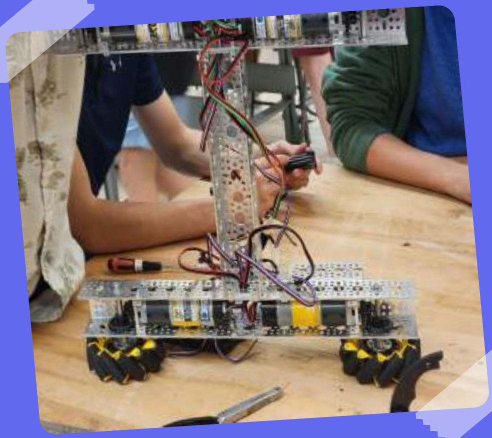
Around this time, we started backwards planning our season, setting goals for when we wanted to reach certain milestones by. This helped us to keep track of our progress and keep on track to maintain good time management. This efficient use of time eliminates crunch time in the week leading up to competition, making sure we are well rested and feeling our best when the time comes.

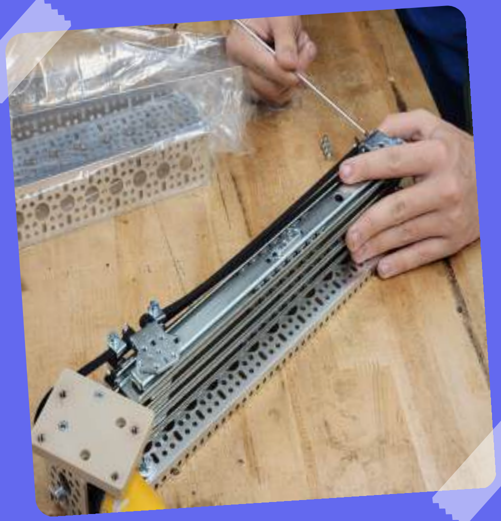


We continued to make more 3D models throughout the season in order to modify different parts over time. Some changes include alterations to the bucket in order to incorporate changes that we made on the fly during our first competition and changing out mounting plates after evaluating why the original ones broke. Again, these parts are all unique to Team 3583.

Build

We converted an A-frame chassis from the previous year into a H-frame chassis. This creates a base that is better for our needs as it provides more open area for the linear slides to move in. Without this style of chassis, the motors would be crammed together, leaving less room for proper wire management. Additionally, the open design allows for more room for our linear slides, allowing the robot to fit into the 18-inch cube.





We use modified 4 stage Viper slides from GoBilda. We choose these due to their quick response. The main modification is the use of different belt for the slides, increasing the durability of them and allowing them to take more wear with constant use. We also added custom 3D printed belt clips to secure them, as well as 3D printed slide mounts to attach them to the chassis. They are mounted at an angle so the we can reach high rungs easier. This angle was calculated using trigonometry. By referencing the distance from the top bucket, the angle from the ground, and the distance of the linear slides, we calculated that the necessary angle needed would be 10°. All of these changes amount to increased efficiency and speed in our cycles.

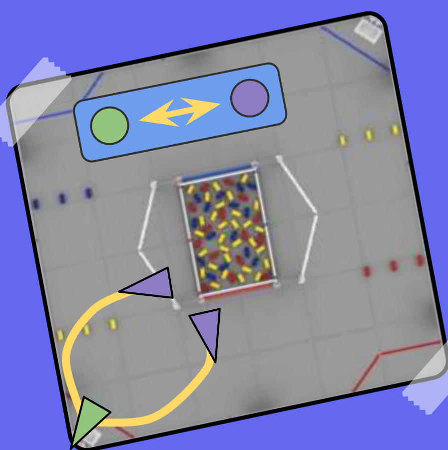
The claw is mounted on a torque servo in order to be able to properly open and close. The prongs of the claw are 3D printed in order for the claw to reach and pick up the sample properly. We went through other different shapes in order to see which effectively picked up the samples, eventually deciding on the triangle shape. We also use another torque servo mounted to a horizontal linear slide to reach samples in the submersible and rotate the claw to reach our bucket, which then raises the samples into the baskets.

The bucket is an adjustable design with the flap able of rotating over 90 degrees while being able to secured effectively with 1 screw. The buckets size and shape were refined through many iterations of similar design. Another new feature in this iteration is a slit to fit the flexible plastic part used for dumping samples.

Programming

TeleOp

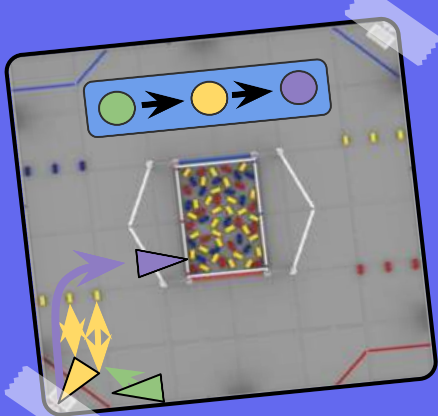
Our robot's TeleOp is designed to be as easy to drive as possible, taking inspiration from popular video games such as Minecraft. Our joysticks allow us to move in any direction, even while rotating the robot, and the triggers on the controllers act as gas pedals to give our drive team exact control over every movement of our bot. The controls for the second player are designed in order to facilitate ease-of-use, including "macros" which allow the second driver to perform some slide functions such as hanging on the submersible far easier controls and a higher degree of precision.



For our teleop strategy, we make use of our back arm and vertical arms being located on opposite sides to allow us to quickly move from the bucket to the submersible without needing to turn, allowing us to score around 8 samples in teleop, equating to 80 points. Additionally, we can perform a level 2 ascent in endgame.

Autonomous

Our autonomous is designed to score points that are easier to get in favor of simplicity, as opposed to a more complicated code with a high chance of fault. We are going to score a total of 51 points in autonomous, since samples scored in autonomous are scored again in teleop. We will score three samples, one preloaded sample and two samples from the spike marks closest to the buckets, and a level one ascent at the end.



While developing our autonomous program, we debated about using vision, and ultimately decided to not use vision due to the April Tags being in spots that we couldn't get the robot to see consistently. By not using vision, we sacrifice a tiny amount of precision that we make up for with clever programming with the motor's encoders and the back claw, in exchange for a much faster robot during autonomous.

Testing

Before getting on the field, we conducted extensive testing to ensure the robot is functioning as intended and can handle the demands of competition. This involves running individual systems like the drivetrain, linear slide mechanisms, and intake to confirm they are operating smoothly and reliably. For example, during our pre-field tests, we discovered an issue with the linear slide motor overheating after extended use, prompting us to adjust its power settings and improve ventilation. We also had a problem with the slide belts rubbing against the chassis, which was causing damage to the belts and limiting the linear slide speed.

These controlled tests also allow us to fine-tune our programming, ensuring autonomous routines are accurate and responsive. By catching and addressing potential problems in a controlled environment, we save valuable time during field testing and increase the overall efficiency of our robot's performance.

During our first field tests, we discovered multiple things on the robot that needed to be reinforced or modified. Running our robot on a practice field allows us to simulate real matches, which helps highlight problems that might show up during FTC Competitions. In one case, we found out that when extended to max height, our vertical linear slides were a little unstable, so this allowed us to solve this problem before competition by bracing the two slides together with a beam in between the two. This adjustment significantly improved the overall stability of the robot, ensuring it could operate reliably under competition conditions.

Additionally, field testing helped us identify other minor issues, such as the need to recalibrate our motors for more precise control. By addressing these challenges early, we increased our confidence in the robot's performance and minimized the risk of unexpected failures during matches, as well as building confidence in our drive team, which increase their overall performance

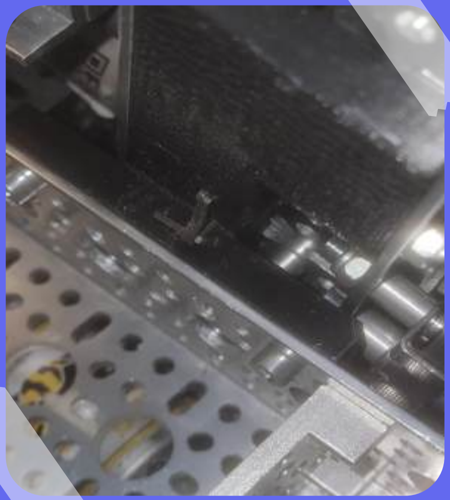
Challenges & Lessons

Our claw at one point stopped being able to open and close completely, which we discovered was because the 3d printed claw pieces that were attached to the claw servo were incorrectly shaped and did not interact with the servo properly. This was fixed by having one of our build members utilize CAD software to modify and re-print claw pieces.

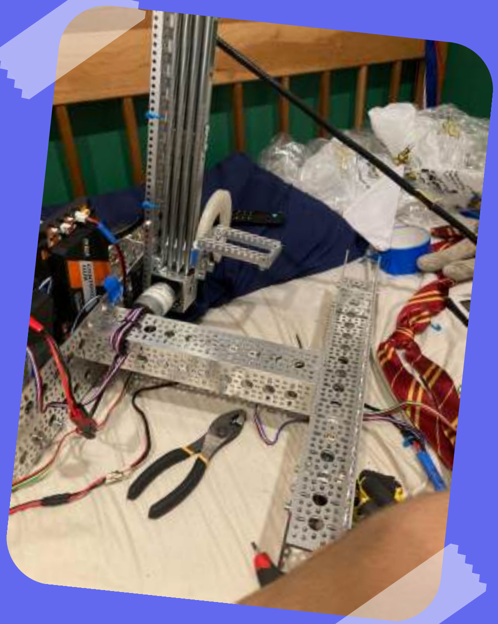
Team communication has also been an area of challenge sometimes. This larger than normal team size (14 of us!) caused a bit of confusion as so many members overlapped job functions and had to learn to plan, explain, and work alongside others in a more direct manner. It was insightful to learn that more hands doesn't always get the work done faster, it can actually cause troubles of its own. This was a big lesson for all.

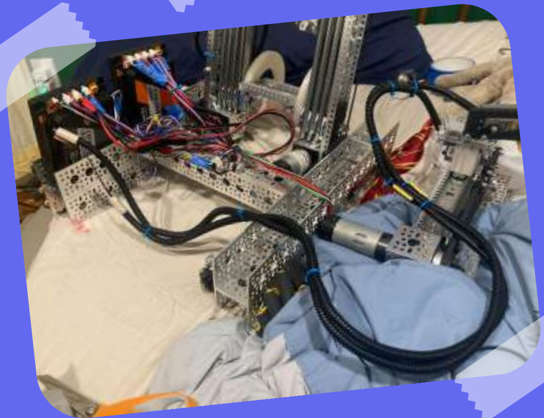
Two days before competition, the left linear slide motor had bent encoder pins, and had to be replaced. Additionally, the wires had to be completely redone as wire management was virtually nonexistent. Overnight, a member was able to replace the motor and rewire the robot. This helped to teach us of the importance of wire management and proper planning.

During the competition in Gaithersburg on Dec 8, our linear belt belt came off during a qualifier. We had to take time in the middle of Tele-Op in order to assess the situation and devise a plan based off what we could do. We found that we were able to reach up to the low basket, so we quickly changed our strategy to do so. This allowed us to continue the qualifier and eventually win said qualifier. This helped us learn the importance of quick thinking and re-checking to see if components are installed properly.



Over the course of the season, our mount for the linear slide broke multiple times. One specific iteration of this is during a drive practices, the mount used for the linear slides broke, hindering our ability to hang and score using the bucket. In order to fix this, we first had to take multiple steps to understand how we could improve it so it wouldn't break again. After understanding that the issue was stability, we extended the plate that attaches to the chassis. Finally, we replaced the mount, something we've had experience doing. This allowed us to learn the importance of stability when using custom made parts and building the robot.





Game Strategy

Our strategy revolves around our cycle time. When you consider Into The Deep scoring methods, you are able to score 8 points from putting a sample in the high basket. By improving cycle time, you can reach a point where it is faster to score 31 points by scoring two samples in the high basket and getting a level two ascent rather than doing a level 3 ascent.

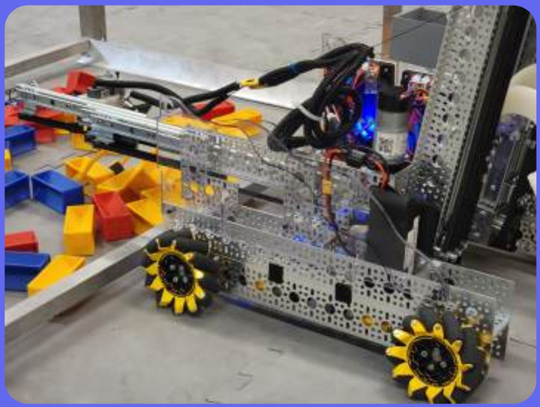
Autonomous	Tele-Op	End Game
Score 3 samples from spike marks	Cycle samples from the submersible to the high basket	Continue scoring samples
Perform a level 1 ascent		Perform a level 2 ascent

Actions:	Auto Samples	Auto Park	Tele-Op Samples	End Game Samples	End Game Hang	Final
Points Earned	24 * 2	3	~40	~16	15	122

The Cybirds season begins with the big reveal day, followed shortly by a thorough examination of the Game Manual. As a group, we gather and brainstorm many concepts. A primary one is the strategy planning that helps us decide how to build the robot itself and which mechanisms are most crucial for point scoring. After thorough analysis, we selected our priority goals and began the build.

Autonomous scoring a sample

Grabbing a sample in tele-op



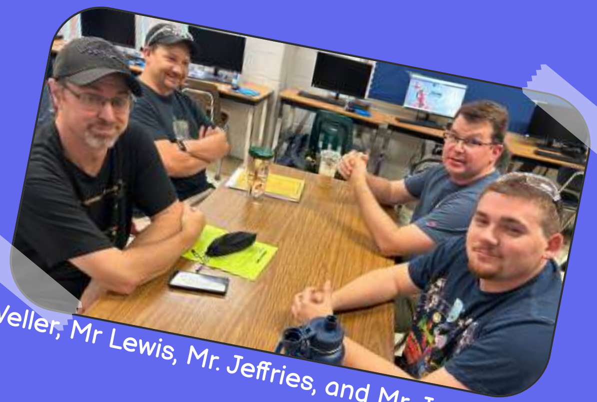
Mentors Teaching Members

We are very grateful to have the many mentors that are here to help our team. Many of them are adult volunteers who are also the parents of members. They typically share interest and are part of STEM fields such as machinists, engineers, and many more.

In build, they have taught us safety procedures and many hands on skills like metalworking and electrical skills. Not only that, but they have taught us how to use CAD to make needed parts for our robots. In programming, they have educated us on how to code in Java and assisted us in debugging the robot, showing us what we did wrong and how to avoid it the next time we come across it. In business, they have helped proofread our work and go over the designs.

Additionally, we have a channel on Slack (our communication medium of choice) where members can ask alumni questions. This allows for us to have constant contact for any support, increasing efficiency and clarifying things that weren't covered in meetings.

Meet the Mentors:
Ms. Feindt - Lead Mentor/Coach, Graphic Design
Mr. Jeffries - Robotics Instructor at USNA
Mr. Josh Powell - Alumni, build specialist
Mr. Lewis - Mentor, Mechanical Engineer
Mr. Maslar - Mentor, business owner, sponsor
Mr. Weller - Lead Mentor #2, Computer IT



Mr. Weller, Mr Lewis, Mr. Jeffries, and Mr. Josh Powell

Mentors helping our members with CAD and teaching them Java

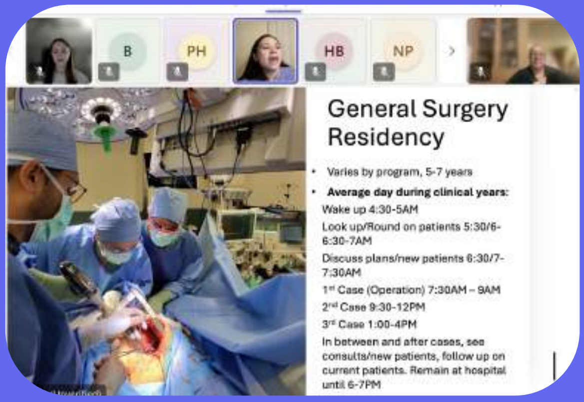
Logo for the alumni questions panel in Slack

Outreach

End of Summer...
On August 21, we participated in the End of Summer Celebration at the Edgewater Library. We were invited to hold a demonstration of the competition field and the season's robot. We helped young kids learn about robotics and programming while letting some of them help us control the bot.

Welcome Back to School!
In August, we manned a table at the high school's freshman orientation event. We showed off some robots, did some light recruiting, and had fun showing off our school spirit. We also spread FIRST ideals through gracious professionalism.

STEM & Robots at the Library
Cybirds spend every first week of April talking up the tech and showing off the robots to our local community for National Robotics Week! This year will be our third year there, and now we have our high school taking part in the celebration with us. This past April, Cybirds hosted a "Tech Try-It" session with digital toys and games before we joined the whole club for the demo.



Women in Stem
This was the 5th annual edition of Women in STEM, where we invite 4 women professionals, each from a different avenue of STEM, to talk about how they got to where they are. This year, the online audience learned all about college options for different careers, such as careers in surgery, accounting and project management, obstacles and challenges, and everything else our panelists throw in. There is also a Q&A for everyone. #WomenInSTEM

Buttons for All!!
A team member makes buttons to give away at competition. We think they are amazing!

Sustainability & Finances

Team #3583 does what we do with the help of many individuals and groups. We are part of a high school club, South River Robotics Club, which hosts 3 total FTC teams, one FRC team, and now a Solar Car Challenge team as well. We have a dedicated non-profit 501(c)3 business, PHRC, Inc., that helps us all of our financial issues.

Our plan for sustainability includes multiple factors which we can explore with you now.

Recruitment of new members:
This year, recruitment was nearly too successful as we quickly approached the maximum number of members on a team. With 14 team members, it seems the steps we have taken have worked well. We reach out to the school both before school begins via social media and at any community events we can arrange to be at. Once school starts, we use word of mouth, informational events such as Ice Cream Socials, and others. We also like to work with the local middle school as we do have some members from those grades as well.

Fundraising/Sponsorships/Grants/Donations:
In addition to seeking costs savings whenever possible, we are constantly in pursuit of season sponsors (more details on the next page), and have also begun looking at more direct member-based fundraisers. We use our funds to purchase the most vital tools, parts and machinery to improve our current season and that will last as long as possible.

Expansion of FIRST® in our region, along with STEM education:
This is our favorite part of our sustainability plan. We love to plan outreach events that include elementary aged kids and even younger so we can try to inspire them with all that STEM topics include. They love to build and create, so it's easy to get them involved. The community as a whole has loved what we do with the area libraries connecting with us regularly for an increasing number of events.

Mitchell and Jacob at an outreach to the library

Leo with one of our generous sponsors

Our parts purchase list

	Component	Amount	Cost per Unit	Total Cost (w/ tax)	Actual D	Part ID (on site)	Order Re	Order	Manufacturer
8	New Wheels	1	$138.74	$147.06		3625-0202-0104	x		GoBuilda
9	Claw	1	$29.99	$31.79		3219-0002-0002	x		GoBuilda
10	Linear Slides	2	$164.99	$349.78		3210-0003-0004	x		GoBuilda
11	Servo Block	1	$29.99	$31.79		3217-0001-2501	x		GoBuilda
12	Servo	1	$49.99	$52.99		2000-0025-0503	x		GoBuilda
13	17 hole U channel	2	$19.99	$42.38		1120-0017-0432	X		go builda
14	Different Servo Blocks	2	$29.99	$63.58		3217-2701-2501	X		Go Builda
15	5 turn dual mode torque servo	2	$49.99	$105.98		2000-0025-0502	X		Go Builda
16	GT2 Timing Belt	1	$12.99	$13.77		3426-0006-0005	X		Go Builda

Our Sponsors

All of our funding comes through the donations of sponsors who donate varying amounts of money. The majority of these donations come from local businesses which support STEM and its growth in our community. We also receive some personal donations from families that support what we do.

We employ a nonprofit 501(c)(3) organization in order to handle money for our program and our team, called PHRC, Inc. This allows us to save money from taxes and expenses, as well as locating opportunities for larger grants.

When receiving donations from businesses, we employ a tiered donation system. Some donors will be recognized on team shirts for the season, and for this we are tremendously thankful. This allows us to utilize a set standard when rewarding sponsors for their generosity.