



# SUPER SCREAM BROS.

TEAM 14204





Howdy! We are the Super SCREAM Bros, Team 14204, a 4th year FTC team based in Macon County, Illinois.



We are a 4-H affiliated team made up of 11 members from various schools in Macon County and we're excited to share our best season yet!

## OUR MOTTO

"A rising tide raises all ships"

- Our team strives to make a positive impact on our community, in and out of FIRST, in order to improve not only ourselves, but everyone we interact with.
- Some ways we live up to our motto:
  - Collaborating with other FTC teams (scrimmages, strategy meetings, etc.)
  - Hosting livestreams for all 3 meets to reach those who could not attend
  - Sharing our CAD designs and Portfolio online for others to learn from



## MISSION STATEMENT

The 4-H SCREAM Super SCREAM Bros. strive to promote the pursuit of knowledge and the FIRST® organization and its values, to build a successful robot using refined engineering skills, programming knowledge, and design principles, and to demonstrate Gracious Professionalism by learning, sharing our knowledge, and inspiring others to do the same.

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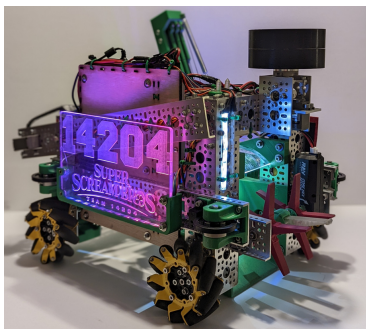
## OUR TEAM



Logan  
Design



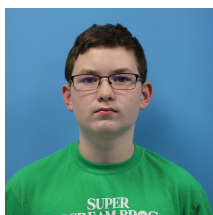
Ben S  
Outreach



Duck Hunt



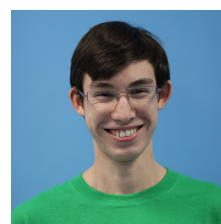
Owen  
Programming,  
Outreach, Drive  
Coach



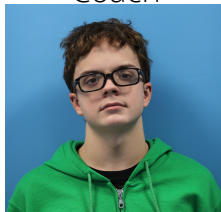
Preston  
Design



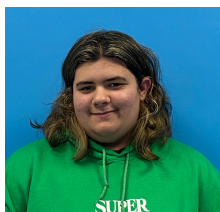
Ben P  
Design, Chassis  
Driver



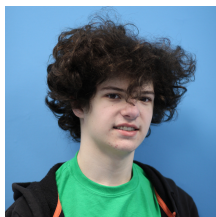
Zach J  
Design, Drive  
Coach



Zach M  
Design



Elizabeth  
Outreach



Noah  
Design, Attachments  
Driver

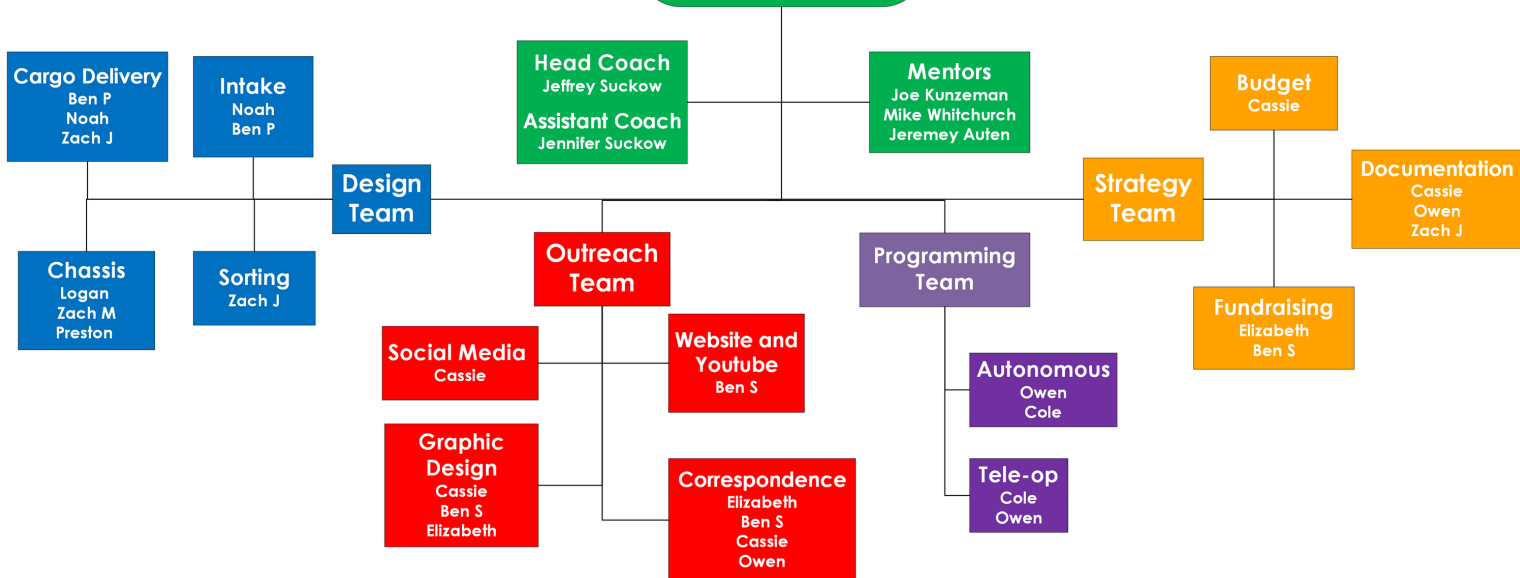


Cassie  
Outreach



Cole  
Programming

### Super SCREAM Bros. 14204



## SEASON GOALS

### STRATEGY GOALS

Goals	Status
Implement agile development system	Completed: The agile development system has become the basis for our documentation and time management
Improve pacing of documentation	Completed: Sprints forced documentation to be paced throughout the season
Make portfolio and engineering notebook more colorful and personalized	Completed
Improve team knowledge of awards	Completed: Made award posters
Improve Team Plan	Completed
More focus on Outreach and Team Plan in portfolio and judging	Completed
Spread notetaking over entire team	Completed
More math and equations within notebook	Completed
More judging practice and review of an expert	Completed
Independent review of our portfolio	Completed
Better file management	Completed
More charts and pictures	Completed
Explore other software for documentation	Completed: We settled on Microsoft Word for its ability to collaborate and be organized in Microsoft teams

### PROGRAMMING GOALS

Goals	Status
Experiment with using a PID for attachment control	Completed: We Used this on many of our attachments
Experiment with logging for data grabbing	Uncompleted
Add more lights for driver feedback	Completed
Improve robot navigation by implementing odometry	Changed Goal: Odometry did not align with our strategy, so we researched using depth cameras for navigation

### OUTREACH GOALS

Goals	Status
Have a designated outreach team	Completed: The team made use of a proper outreach team this season
Improve Social Media Presence	Completed: Gained 135 Instagram followers and 81 Subscribers on YouTube
Improve our variety of mentors and experts	Completed
Improve relations with FTC teams outside of our division	Partially Completed
Improve relations with FTC teams inside of our division	Completed: Grew relations with multiple teams such as Control Y and Robot Rebellion
Work to improve the strength of our local FTC programs	Completed: Hosted multiple Strategy meetings with local teams

### DESIGN GOALS

Goals	Status
Implement Odometry	Changed Goal: Odometry did not align with our game strategy, so we researched other ways to improve navigation
Decrease physical iterations by iterating within CAD	Completed: used to make many of our designs in only one print
Make use of laser cutter for faster prototyping with cardboard and wood	Completed
Make use of resin printer for use of more flexible prints	Completed: used for our intake wheels

## TOTAL IMPACT SUMMARY

Media	
Total Media Reach	11846
YouTube Reach	6090
Social Media Reach	5756
Subscribers and Followers Gained	251
YouTube Videos	14
Instagram/Facebook Posts	88

Expert Events	
Total Experts	16
Expert Meetings	22
Design Experts	6
Programming Experts	2
Fundraising and Outreach	4
Team Organization and Strategy	7

Total Outreach Events	38
Total People Reached	14,344
Total Team Hours	129.5
Total Man Hours	1072.5

Outreach Events	
Total Events	22
People Reached	2392
Team Hours (at events)	102.5
Man Hours (at events)	911.5

## OUTREACH EVENTS

We have participated in 22 Outreach Events this season, here are some of our most notable ones:

### STRENGTHENING OUR FIRST RELATIONSHIPS

#### STRATEGY MEETINGS AND SCRIMMAGES WITH DCS

We have participated in 6 meetings with DCS Mechwarriors 14840 to discuss strategy and practice driving

People Reached: 11  
Team Hours: 12  
Team Members: 11

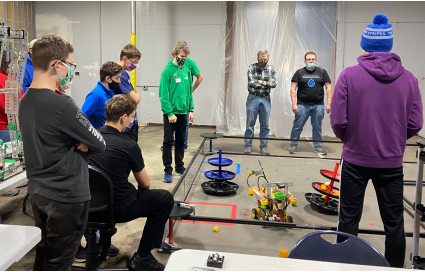


#### CENTRAL-SOUTHERN SCRIMMAGE

We invited all of the state-bound teams from the Central-Southern Division to our facility to share designs and portfolios, practice driving, and build relationships

Resulted in all participants feeling better prepared for state and inspired by our peers' work, and a sense of community within our division

People Reached: 40  
Team Hours: 4  
Team Members: 11



#### HOSTING FLL QUALIFIER

We hosted the Decatur FLL Qualifier and provided a table with our robots where people could learn about FTC

People Reached: 375  
Team Hours: 7  
Team Members: 11

Resulted in several FLL participants saying they were interested in joining FTC in the future



#### HELPING 4-H SCREAM

We helped our sister FLL team, 4-H SCREAM, practice their project presentation and robot judging before they competed at state

People Reached: 5  
Team Hours: 2  
Team Members: 9



#### HOSTING FTC MEETS

We have Co-Hosted two FTC Meets, providing field materials, a livestream, and setup assistance

People Reached: 150  
Team Hours: 12  
Team Members: 11



## SPREADING STEM & FIRST



### CUB SCOUT DEMO

People Reached: 15  
Team Hours: 2  
Team Members: 6

We gave a presentation about FIRST and our team and the let the Cub Scouts drive our robots

Resulted in 2 scouts inquiring about joining FLL



### SCREAM STEAM

People Reached: 9  
Team Hours: 11  
Team Members: 7

We held a 7-week camp for youth ages 8-18, in order to promote STEM in our community. Each week was a different theme ranging from programming to 3-D modeling to rocketry.

Resulted in 3 students contacting the FLL team



### ILLINOIS STATE FAIR EXHIBIT

People Reached: 500  
Team Hours: 8  
Team Members: 9

We had an exhibit at the State Fair where we welcomed passers by to drive our robots and learn about FIRST, and also got to interact with other STEAM exhibitors around our booth

Interested in FLL	
Name	Teacher
Kristopher	Joyner
Nesiah	Petrie
Julien	Mr. PacWer
AUSTYN	Hubbard
Khai	
Chase	LoLerd
Quynah	Mrs. Hubbard
Addison	Mrs. Swanberg

### MONTESSORY ACADEMY DEMO

Resulted in 8 students showing interest in joining an FLL team and the school's staff inquiring about starting an FLL team at their school (with our help)

We told students (K - 8th grade) at the after school program about FTC and FLL, and allowed them to drive our robots

People Reached: 30  
Team Hours: 2  
Team Members: 7



EVERY STUDENT IN THE 4TH - 8TH GROUP SHOWED INTEREST IN JOINING FIRST

### OTHER OUTREACH EVENTS:

- 4-H Dewitt Macon Piatt Fair
- CRI Competition
- Ri3D
- Explore STEAM
- Blue Bots Meeting
- Caterpillar Design review with DCS



### WARRENSBURG MS DEMO

We showed the Warrensburg Middle School STEM class a presentation about FIRST and a video of one of our FTC matches. We then allowed them to drive our robot.

People Reached: 35  
Team Hours: 2  
Team Members: 3

Resulted in 2 students showing interest in joining FTC




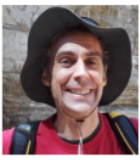

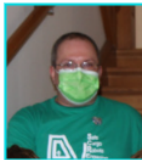
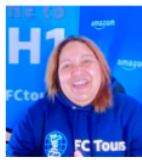


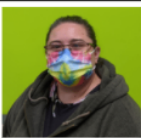



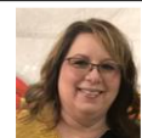
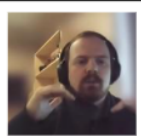

### OVERALL, THROUGH OUR OUTREACH EFFORTS WE HAVE:

- Inspired over 15 students to pursue FIRST programs
- Collaborated and built relationships with 6 FTC teams
- Shared FIRST with 2 schools
- Advised an FLL team

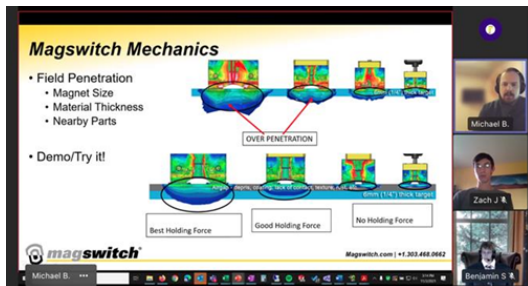
## EXPERT OUTREACH

We strive to meet with EXPERTS that can help IMPROVE all aspects of our team

This season we met with 16 EXPERTS OVERALL, 11 more than last year (meeting our goal of contacting more experts)

							
MR. JALLEY Agile development	MRS. PASQUARIELLO Team building and conflict management	MR. KUNZEMAN Game strategy and design	MR. WHITCHURCH Programming	MS. LIGHTNER Outreach and media	MR. AUTEN OBS and Resin/3D printing	AMAZON EXECUTIVES Real world freight management	MR. RALEIGH Portfolio
							
MRS. METCALF Outreach and graphic design	MS. CORNETT Fundraising	MR. SUCKOW Design and game strategy	MR. SHAFFER Programming (object detection)	MRS. SUCKOW Outreach and team management	MRS. WIKOFF Portfolio	MR. BLANCHARD Magnet Arm	CATERPILLAR DESIGN ENGINEERS Design

### EXPERT MEETINGS WITH MR. BLANCHARD



**PROBLEM:** While designing our magnet arm, we saw that none of our prototype switchable magnets were strong enough to effectively lift weighted blocks

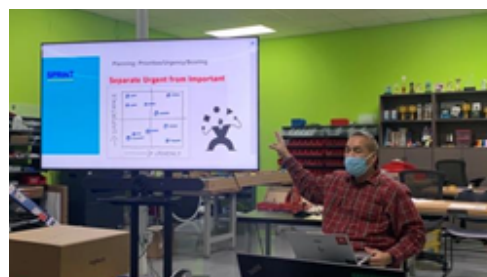
**EXPERT:** Whilst searching for solutions, the design team came across a switchable magnet company called MAGSWITCH and scheduled a meeting with them thereafter. Mr. Blanchard, Magswitch's Senior Engineering and Systems manager, provided new DATA AND INFORMATION and also DONATED some of their product for us to experiment with.

**IMPACT:** The KNOWLEDGE AND MATERIALS acquired from Magswitch allowed us to fully develop one of the most UNIQUE parts of our robot, effectively DOUBLING the weight we could pick up with our magnet, therefore giving us new STRATEGIC OPTIONS in the robot game

**PROBLEM:** Our team decided to utilize the AGILE DEVELOPMENT SYSTEM this year and desired help navigating it

**EXPERT:** We held a meeting with Mr. Jalley, an Agile Expert that works for State Farm, at which he talked to us about how he uses Agile at his job and taught us some new terminology and SPRINT ORGANIZATION that we had not been introduced to before

**IMPACT:** The KNOWLEDGE we acquired from Mr. Jalley gave us new insights into Agile, allowing us to have a more REFINED AND EFFICIENT season strategy



### EXPERT MEETING WITH MR. JALLEY

### CAT DESIGN REVIEW



**PROBLEM:** Our team desired to have experts review our designs and give us advice

**EXPERT:** We hosted an hour-long video call in which our team and DCS Mechwarriors 14840 showed 90 CATERPILLAR ENGINEERS our robots and asked for feedback

**IMPACT:** We gained EXPERIENCE presenting our designs in front of a PROFESSIONAL audience and were able to interact with more than just FIRST affiliated design experts



# MEDIA

This year one of our goals was to increase our online presence. We accomplished this by creating our own website, making YouTube videos about our robot, livestreaming competitions, engaging with those interested in FIRST through Instagram and Facebook, and participating in a radio and television interview

## YOUTUBE

We use our YouTube Channel to share videos of our innovations with others and to also host livestreams of big events to allow those who could not attend in person to participate. Our YouTube has allowed us to promote FIRST and STEM to thousands of people.

### VIDEOS (5)

1. Ri3D RECAP - A review of all of the prototypes and findings we made during our Robot in 3 Days
2. Raised Strafer Chassis - A look at our modified GoBILDA straffer chassis, including information about our wheel guards
3. Magnet Arm - A look at our magnet arm and how we used our design process and expert meetings to create it
4. Promote Video - A submission for the Promote Award in which we interviewed our team members about what they wish they'd known about FIRST
5. Livestream Hardware - A description of the hardware that we use to livestream meets for teams wishing to do the same

## SOCIAL MEDIA

INSTAGRAM - Used to meet and communicate with other FTC teams

163 FOLLOWERS, 731 REACHED

FACEBOOK - Used to inform parents and other teams about our team's events and designs

136 PAGE LIKES, 8.4K REACHED

## OTHER MEDIA

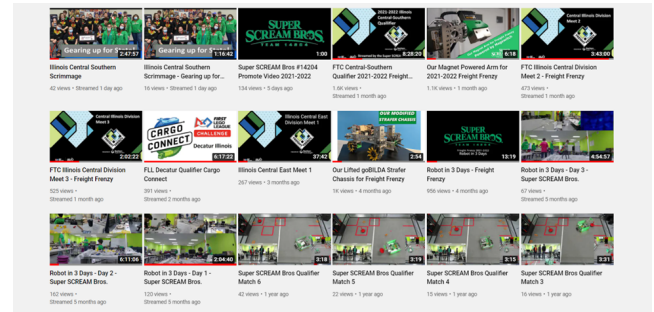
### TELEVISION INTERVIEW

Our team, along with DCS Mechwarriors, was interviewed by WAND, a local news channel. We told them about our qualification for state and about FTC in General.



### RADIO INTERVIEW

We participated in an interview on WHOW, where we talked about STEM, FIRST, and our team's journey



### LIVESTREAMS (9)

- Each day of our Robot in 3 Days (3)
- One for each FTC Meet (3)
- Decatur FLL Qualifier (1)
- Central-Southern Illinois FTC Qualifier (1)
- Central-Southern Scrimmage (1)

### STATISTICS

- 122 Subscribers (83 gained this season)
- 4.7K views
- 55.2K impressions



## WEBSITE

On our website, we SHARE our CAD Designs and our Portfolio with the goal of helping other teams learn from our work



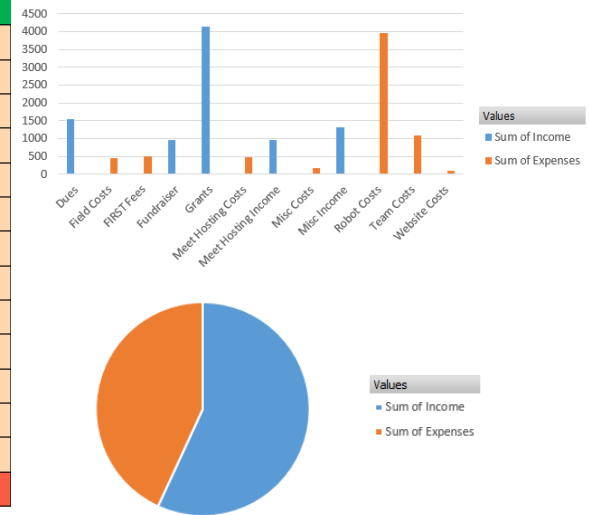
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## BUDGET

\* We have also received approximately \$1000 worth of material donations (tools, stationary, banner supplies) from Lowe's Hardware, Magswitch, and Staples

Season Income		Season Expenses	
<b>Grants/Donations</b>		<b>FIRST Fees</b>	<b>500.00</b>
Caterpillar	1024.00	<b>Field Costs</b>	<b>450.50</b>
Flipside Technologies	1280.00	<b>Robot Costs</b>	<b>3950.50</b>
Macon County 4-H	1426.00	<b>Team Costs</b>	<b>1097.83</b>
Anonymous	400.00	<b>Website Costs</b>	<b>106.20</b>
Subtotal	<b>4130.00</b>	<b>Meet Hosting Costs</b>	<b>479.92</b>
<b>Fundraisers</b>		<b>Misc. Expenses</b>	<b>164.00</b>
4-H T-Shirts	645.00		
4-H Tumblers	305.00		
Subtotal	<b>950.00</b>		
<b>Dues</b>	<b>1540.00</b>		
<b>Meet Hosting Costs</b>	<b>955.00</b>		
<b>Misc. Income</b>	<b>1325.00</b>		
<b>Total Income</b>	<b>\$8900.00</b>	<b>Total Expenses</b>	<b>\$6748.95</b>



- We have made MORE INCOME THAN EXPENSES, which was one of our goals this season. It also gives us a head start on next seasons budget.
- We have also made more income than any previous season, allowing us to have freedom to purchase more expensive items that we've never had access to, such as a T265 camera and a color printer.

## FUNDRAISING AND SPONSORS

Our sponsors:



Our team raises money in 2 main ways:

1. ORGANIZING FUNDRAISERS
  - 4-H Fair T-Shirts - We sold T-Shirts at the Dewitt-Macon-Piatt 4-H County Fair
  - 4-H Tumblers - We sold 4-H themed tumblers (engraved by our laser cutter) virtually
2. GRANT APPLICATIONS
  - Rev Grant
  - Title 1 Schools Grant
  - Caterpillar Grant
  - Macon County 4-H & Extension Foundation Grant



## SUSTAINABILITY



SUPPORTING 4-H SCREAM

Our team gains new members through our sister FLL Team (4-H SCREAM), Outreach Events that inform people about FIRST, and recruitment through word of mouth. This season we specifically recruited members for our first ever designated Outreach team. Overall, due to our sustainability efforts we have gained four new members this season: Elizabeth, Zach M, Preston, and Cassie.

## AGILE DEVELOPMENT SYSTEM

This season we implemented the Agile Development System to make our season more efficient and organized

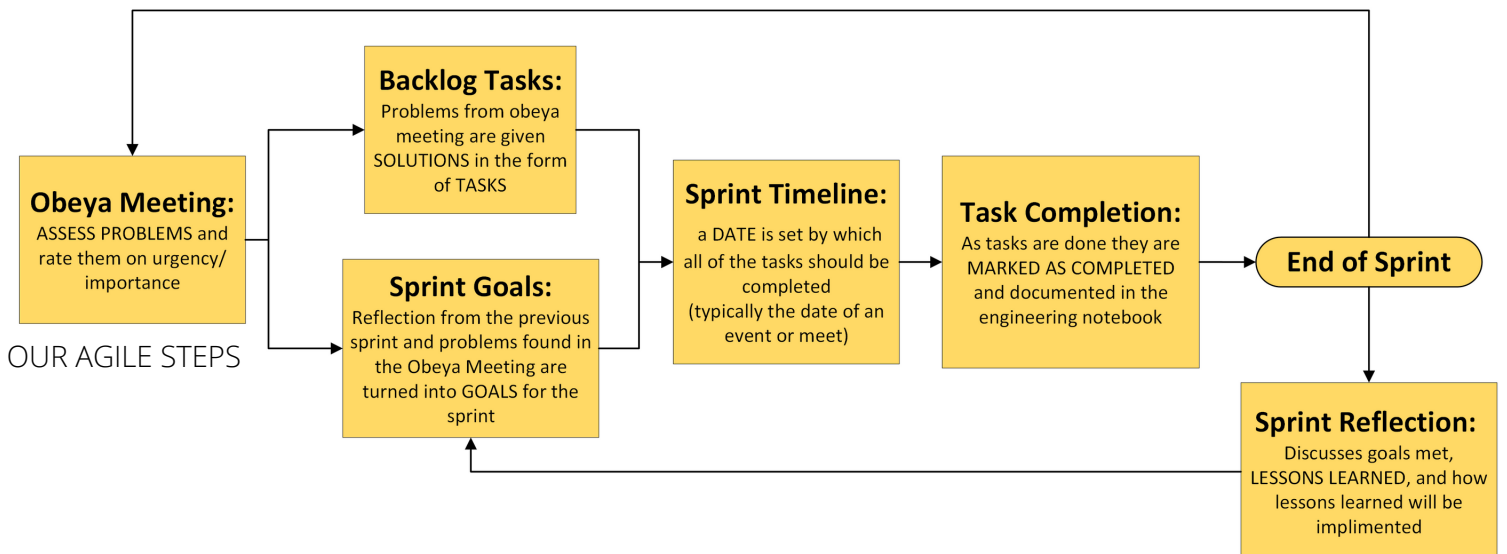
- Agile Development is a system in which PRODUCTIVITY is encouraged in a workplace through the utilization of sprint goals guided by TIMELINES and an emphasis on REFLECTION after each sprint is done.
- We were INSPIRED to use Agile development by our sister FLL team (4-H SCREAM) and furthered our knowledge of it by talking with Mr. Jalley, an Agile Expert from State Farm
- We center our Design and Programming sprint timelines around the important landmarks in our season (Ri3D, Meets, and Qualifier)
- Agile helps our team be more efficient, organized, communicative, and prepared for the future

Our season is organized into SPRINTS, sets of tasks with a set timeline attached to it, that are made up of goals, tasks, and a reflection

Task	Status	Category	Date added
Git Repository Setup	Done	Git	9/18/2021
Simplify Our Repository	Done	Git	9/18/2021
Experiment with servo output controlling RC Swi	Done	Reverse Mode Lights	9/18/2021
Experiment with DC esc	Depreciated	Reverse Mode Lights	9/18/2021
Test object detection	Done	Cameras	9/18/2021

All of our tasks are written down in a BACKLOG on Excel that records the tasks' status of being completed (not started, in progress, completed)

After every Meet we hold an OBEYA MEETING in which the entire team comes together to identify problems that were noticed at the Meet and then assigns the SOLUTIONS to different sub teams (solutions are then tasks that are put into the backlog)



## DESIGN STRATEGIES

### 1. "THE MUSK METHOD"

Inspired by an interview with Elon Musk, we choose to "eliminate dumb requirements"

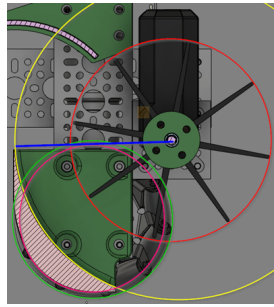
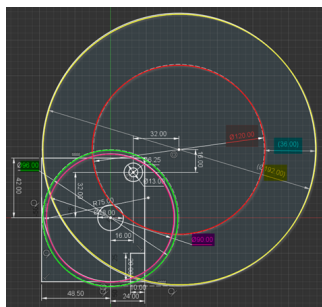
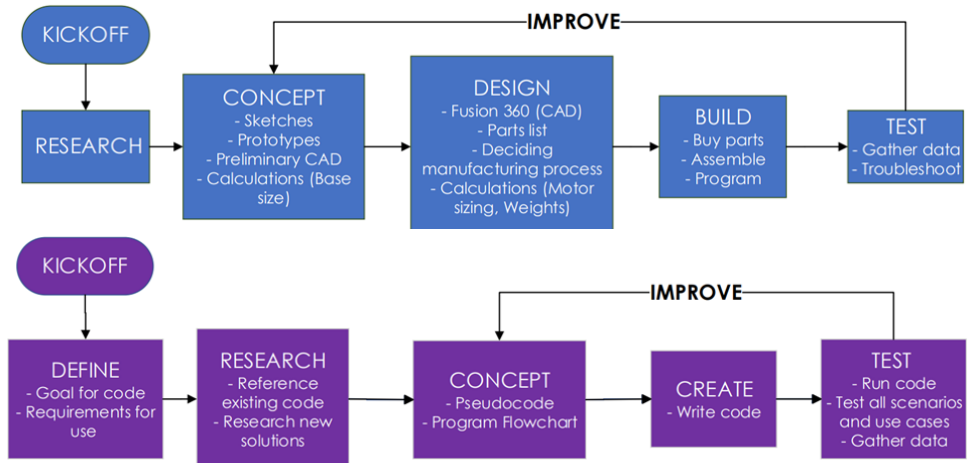
By using this philosophy, we strive to not only stop doing things that have no purpose, but to also eliminate the useless requirements we set for ourselves in the first place

### 2. ENGINEERING DESIGN PROCESS

We have both an Engineering (EDP) and Programming (PDP) Design Process

Our design processes help us effectively transition from concept to design

We have also designed our Notebook Documentation process around the EDP and PDP allowing us to stay organized and driven by our design principles



Red	The intake wheels: size 120 mm
Yellow	The inside part of the bucket: size 192mm (matches the curve of the intake wheels)
Green	The drive wheels: size 96 mm
Pink	The back/bottom of the ramp: size 90 mm (furthest back point of drive wheels matches that of slide to prevent contact with barriers)
Blue	The top of the ramp in relationship to the intake wheels (level with the center of wheels)

- This season, the Design team made use of its in-CAD validation strategy with the intake by creating a complete CAD model before printing our first ramp
  - This allowed us to validate its ability to clear the ground, barriers, and stay in line with the intake wheels
- Because of this system we only had to print ONE ramp, bringing our iteration time from DAYS TO HOURS

### 4. RAPID PROTOTYPING

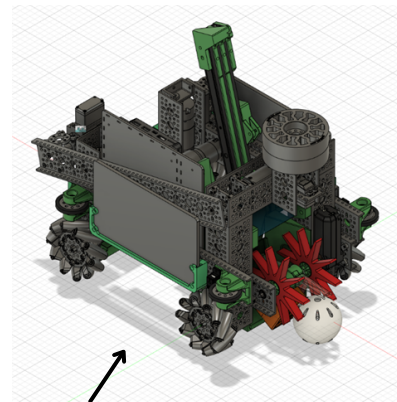
We are able to rapidly prototype our design ideas through the utilization of MACHINERY

We make custom designs through the use of laser cut cardboard and wood and 3D printed PETG and resin

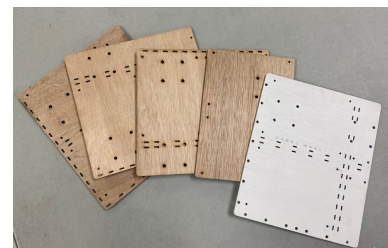
The rapid pace of prototyping and specificity to our requirements allows us to RAPIDLY INNOVATE our parts without having to rely on purchasing parts from other manufactures

### 3. TOP-DOWN DESIGN

In our CAD designs, we create a top-level model in Fusion 360 and use that model to validate the parts we design before manufacturing



The top-level model that we use to see whether our parts will fit on the robot prior to actually printing or cutting them



Our many electronics board iterations made on the laser cutter

Our robot consists of 110 manufactured parts and 48 ORIGINAL DESIGNS

## GAME STRATEGY

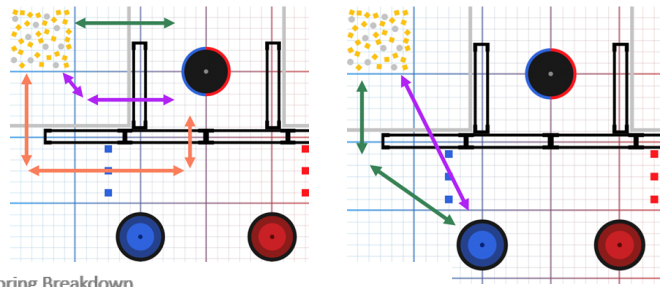
Two main takeaways from our strategy meeting with Expert Mr. Kunzeman:

1. It's not about winning matches, it's about accumulating points
2. The shared hub is a 40 point swing and should be prioritized

### CORE PLAN

- |  |  |   |
|--|--|---|
| <p><b>Autonomous:</b></p> <ul style="list-style-type: none"> <li>Created two programs on each side to fit the different roles of the autonomous portion</li> <li>Made the carousel side programs deliver the pre-loaded freight on the side of the Alliance Hub rather than the front to avoid collisions             <ul style="list-style-type: none"> <li>Prior to this development, we would strategically place wait segments to accommodate our partner</li> </ul> </li> </ul> | <p><b>Tele-OP:</b></p> <ul style="list-style-type: none"> <li>One team goes for primarily the alliance shipping hub, while the other fights for the shared             <ul style="list-style-type: none"> <li>When going for the alliance shipping hub                 <ul style="list-style-type: none"> <li>Top tier is the priority</li> <li>We adopted the strategy of grabbing the ducks off of the ground at the game's start when we are in charge of this position</li> <li>We decided that balancing the alliance shipping hub was not a priority                     <ul style="list-style-type: none"> <li>It can fall too easily, and the point value is minimal compared to the care required to keep it up</li> </ul> </li> </ul> </li> <li>When going for the shared hub                 <ul style="list-style-type: none"> <li>We have two different feasible routes, and one last-ditch effort</li> </ul> </li> </ul> </li> </ul> | <p><b>End Game:</b></p> <ul style="list-style-type: none"> <li>Ducks are the highest priority, and will be done by whoever is doing the alliance hub             <ul style="list-style-type: none"> <li>Ducks became highest priority when our team learned that ranking was going to be based off of total points scored, and not win/loss</li> </ul> </li> <li>Ensuring the shared hub falls our way is the next highest priority             <ul style="list-style-type: none"> <li>However, we will not focus on it if the situation is particularly one-sided, since points are not assured</li> </ul> </li> <li>TSE if not doing ducks or shared</li> <li>Getting more cargo into the top tier of the alliance hub is what we do if all other jobs are taken care of or unfeasible</li> </ul> |
|--|--|---|

### TELE-OP ROUTE OPTIONS

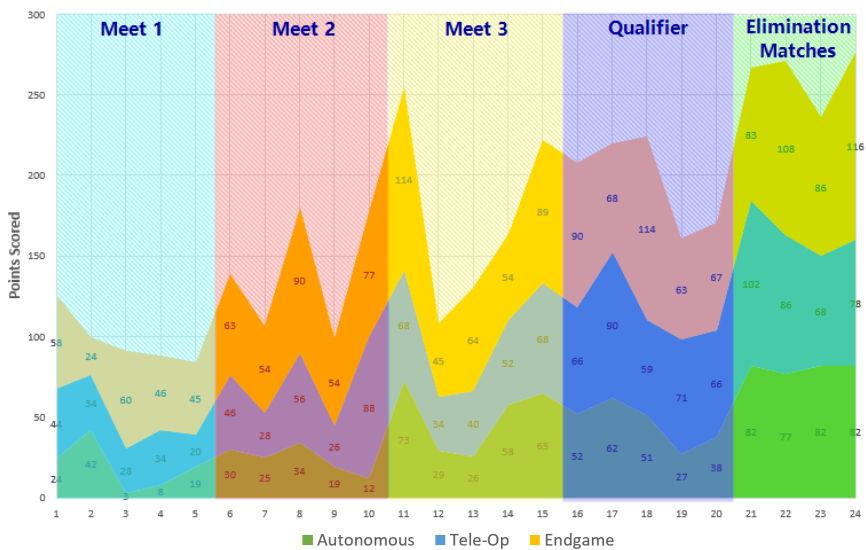


### EFFORTS THAT HAVE IMPROVED OUR GAME PERFORMANCE:

- Working with DCS Mechwarriors at scrimmages and strategy meetings
- Our drive team performing TIME TRIALS to see what their average cycle times were when using various strategies
- Adding ferrous material to our TSE so that our magnet arm can easily pick it up and place it
- Working with Ctrl-Y to develop a TSE that could be easily stacked if we happened to be partners. When we were, we broke the state record in points, being the first alliance to DOUBLE-CAP in the Central Division

- Creating and dispersing SCOUTING PAPERS with our robot's capabilities on them as well as papers for our own notes to inform and learn about potential allies

2021-2022 Scoring Breakdown  
(Penalties Not Included)



IMPLEMENTATION OF MORE REFINED STRATEGY HELPED US IMPROVE AT EACH COMPETITION

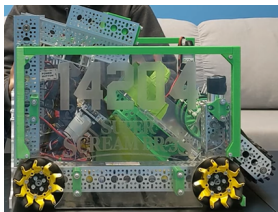
# SUPER SCREAM BROS.

TEAM 14204

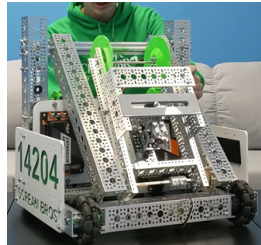
## CHASSIS

During ROBOT IN 3 DAYS, we tested out 4 different chassis to see which ones were able to go OVER THE BARRIERS and were overall EASIEST TO DRIVE

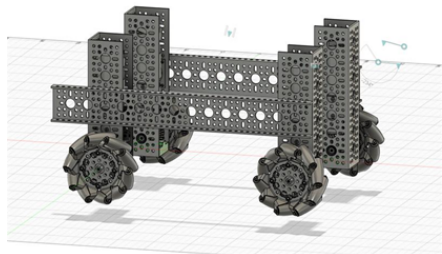
We chose to use the STRAFER WHEELS because they maneuver quickly while also being able to go over the barriers



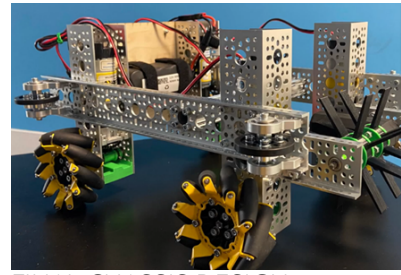
STRAFER



85MM 4-WHEEL DRIVE



FINAL CHASSIS IN CAD



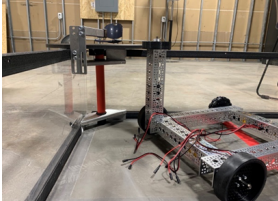
FINAL CHASSIS DESIGN

We also wanted to make our chassis SMALLER and TALLER than usual in order to fit around the gap beside the barriers while also being able to easily drive over the barriers and freight

We created VERTICALLY oriented wheel motor holders in order to ensure the compactness of the chassis



HOLONOMIC DRIVE



120MM 4-WHEEL DRIVE

## TEAM SHIPPING ELEMENT

We designed and 3D PRINTED a TSE and PROGRAMMED our robot to sense it in autonomous  
Our TSE's walls are lined with STEEL PLATES, allowing our magnet arm to be able to lift it for capping  
It is also HEXAGONAL, preventing it from rolling if knocked over



FINAL TSE DESIGN

We made MANY ITERATIONS before deciding which TSE worked best for us



We also COLLABORATED with CTRL-Y (Team 12971) by printing their TSE, allowing our alliance to be the first in our division to DOUBLE CAP



## NUMBER PLATES

The purpose of the number plates is to communicate our team number

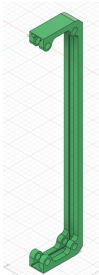
Our team number is engraved into acrylic and is surrounded by LED LIGHTS that illuminate the number and are also programmed to COMMUNICATE the TIME in the match and whether there is freight in the bucket



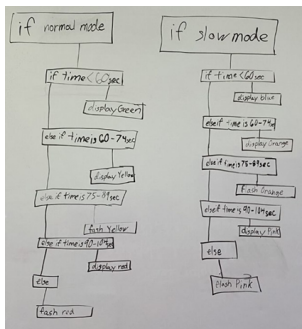
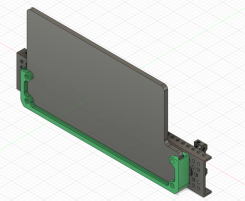
ORIGINAL WOODEN PLATES



FINAL NUMBER PLATES



3D PRINTED LIGHT HOLDERS AND NUMBER PLATE HOLDER



The lights CHANGE COLOR when there is FREIGHT IN THE BUCKET, alerting the drivers to turn off the intake  
The TIME of the program also determines the color of the lights turning from green to yellow to red indicating the amount of time left in the match.

## INTAKE

This season one of our goals was to keep our intake as SIMPLE as possible. This let us iterate on it extremely quickly.

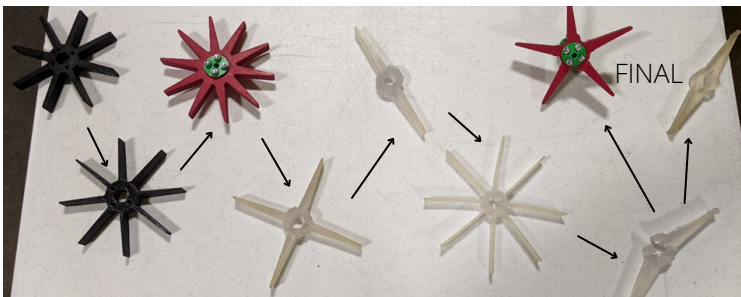
We went through MANY DIFFERENT INTAKE WHEEL DESIGNS throughout the season.

The final design was chosen for its excellence in picking up freight and its simplicity (making it easy to take it apart when problems arise).

Rating system for freight Intake: Bad, Okay, Good, Excellent

Type of wheel	TPU filament wheel	Andymark	Medium thickness resin	Three-wheel first design	Three-wheel last design
Balls	<span style="color: yellow;">Okay</span>	<span style="color: red;">Bad</span>	<span style="color: yellow;">Okay</span>	<span style="color: green;">Good</span>	<span style="color: cyan;">Excellent</span>
Light blocks	<span style="color: green;">Good</span>	<span style="color: yellow;">Okay</span>	<span style="color: green;">Good</span>	<span style="color: cyan;">Excellent</span>	<span style="color: cyan;">Excellent</span>
Medium blocks	<span style="color: yellow;">Okay</span>	<span style="color: green;">Good</span>	<span style="color: yellow;">Okay</span>	<span style="color: green;">Good</span>	<span style="color: cyan;">Excellent</span>
Heavy blocks	<span style="color: red;">Bad</span>	<span style="color: yellow;">Okay</span>	<span style="color: yellow;">Okay</span>	<span style="color: yellow;">Okay</span>	<span style="color: cyan;">Excellent</span>
ducks	<span style="color: yellow;">Okay</span>	<span style="color: red;">Bad</span>	<span style="color: yellow;">Okay</span>	<span style="color: green;">Good</span>	<span style="color: green;">Good</span>

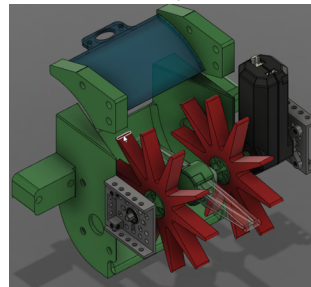
Intake testing and comparison



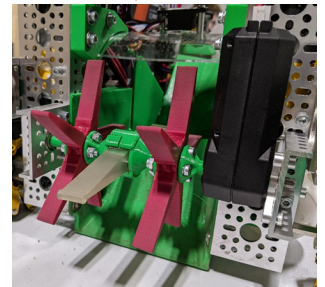
All of our intake iterations

### THE FINAL INTAKE DESIGN

Two Andymark entrapment stars with spokes cut off and one resin printed wheel with two wide spokes



FINAL INTAKE IN CAD

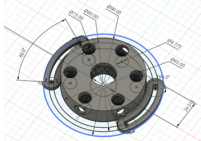
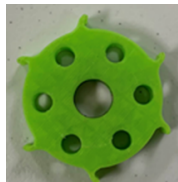


FINAL INTAKE ON ROBOT

## MAGNET ARM

We wanted to design a SWITCHABLE MAGNET that would allow us to pick up and drop things that have ferrous material in them.

The magnet's purpose was for targeting and PICKING UP WEIGHTED FREIGHT to better control the balance of the shipping hubs, and we later found it to be useful for CAPPING as well.



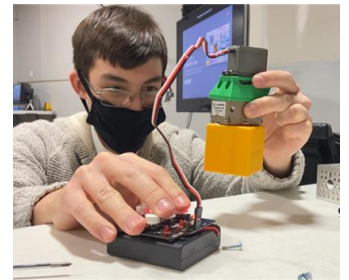
MANY PROTOTYPES were unsuccessful

Issues with Prototypes:

- Too much plastic covering magnets
- Air gaps due to rough cut nature

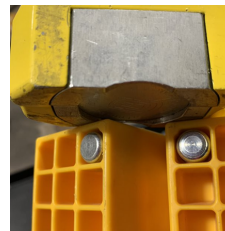
After an EXPERT MEETING with Magswitch, we were donated switchable magnets that we used in our final design

We then designed and 3D printed attachments to hold and control the magnet as well as a moveable arm that attached to the chassis

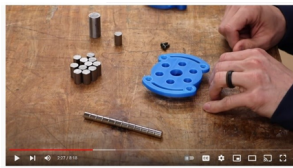


We met with Magswitch again after Qualifier for advice on how to improve our magnet's strength

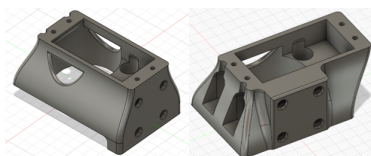
We tried both of their suggestions, more friction and a larger magnet, but both changes caused more harm than benefit, so we stuck to our original design



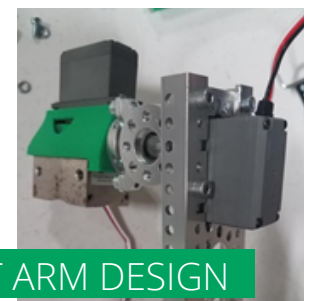
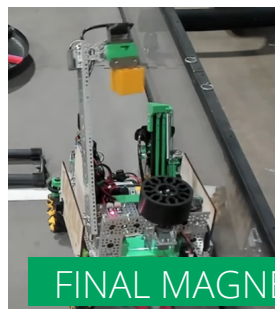
THE BIG MAGNET PICKED UP 2 BLOCKS



We were inspired by a YouTube video by Andrew Klein



Magnet attachment CAD designs

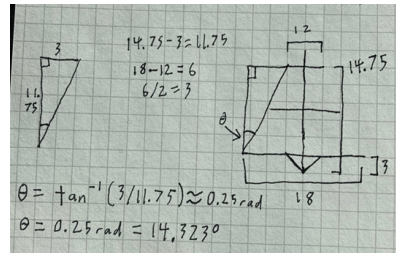


FINAL MAGNET ARM DESIGN

## CARGO DELIVERY SLIDE

We wanted our cargo delivery system to be both LIGHT and FAST in order to be able to move a lot of freight while also keeping within our size limitations

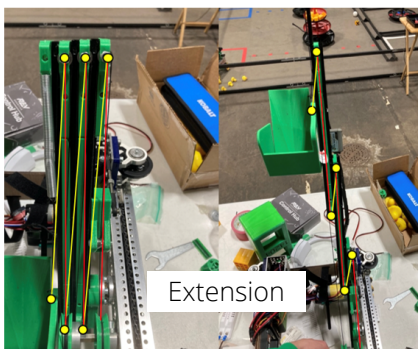
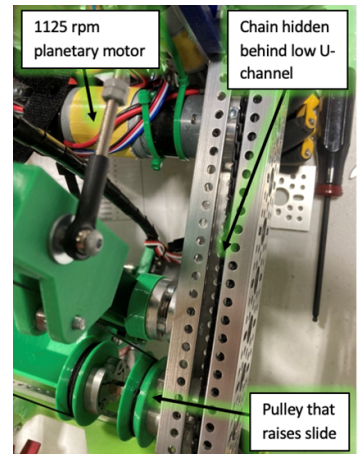
To accomplish this we chose to use a LINEAR SLIDE and decided on using a MODIFIED Long Robotics slide



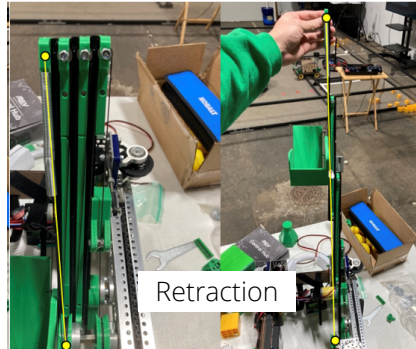
We extended and retracted the slide with pulleys. This allows extension and retraction to be possible with ONE ROTATION INPUT

We also reinforced the slide when it bent after falling off a table

We found the OPTIMAL ANGLE at which to position the slide by CALCULATING the angle of the shared shipping hub's tiers.

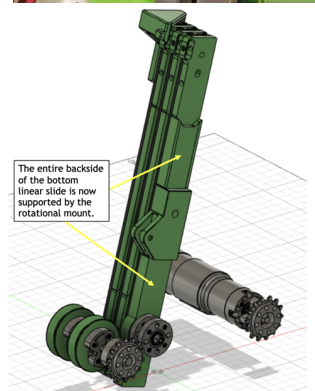


Extension



Retraction

FINAL SLIDE ON ROBOT



FINAL SLIDE IN CAD

## CAROUSEL SPINNER

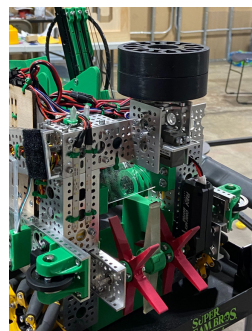
During Robot in 3 Days, we made a PROTOTYPE with a motor and 2 gecko wheels

After TESTING to find the fastest speed at which the carousel could spin without throwing the ducks off (210 RPM), we opted for a super speed servo as it is the only servo that goes that fast

The final carousel spinner was placed in the center of the robot to EASILY ACCESS the carousel on both the red and blue sides



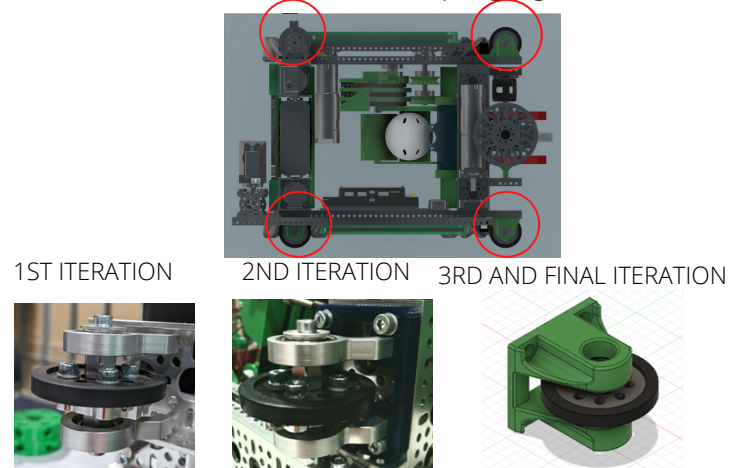
ORIGINAL PROTOTYPE



FINAL SPINNER

## SIDE ROLLERS

We designed SIDE ROLLERS to allow us to quickly and easily drive between the barriers and the wall without scraping against either



1ST ITERATION

2ND ITERATION

3RD AND FINAL ITERATION

# SUPER SCREAM BROS.

TEAM 14204

## TELE-OP

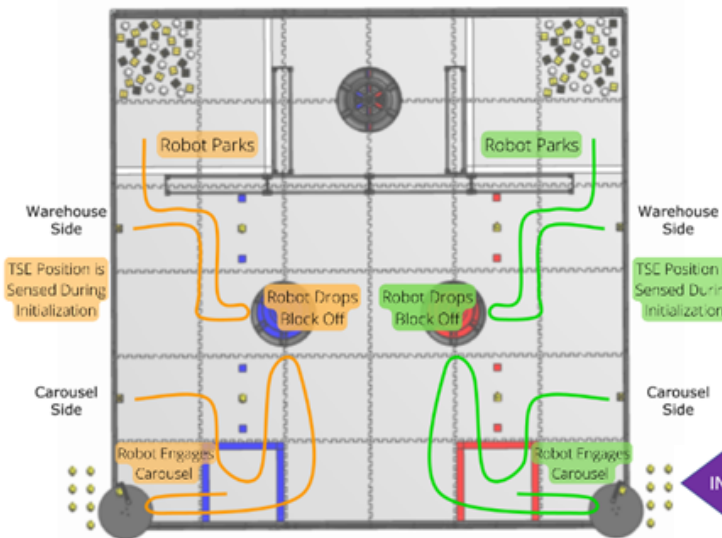
CHASSIS CONTROL



ATTACHMENTS CONTROL



## AUTONOMOUS



HEADING CORRECTION

The Autonomous segments feature proportional heading correction using the IMU sensor in the control hub. This is referenced to a set heading and correction values are subtracted from certain motors.

RAMP-UP RAMP-DOWN

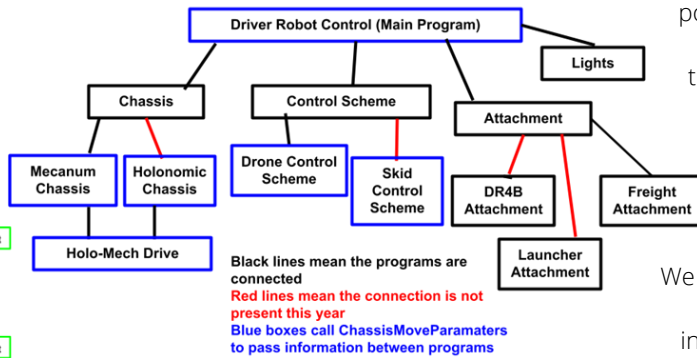
These segments also feature a ramp up and ramp down which prevents sliding when the robot makes a stop, improving accuracy while driving

The goal for Tele-Op was to make controlling the robot as easy as possible for the Drive Team

## CLASS STRUCTURE

To make the programming of new robots easier, the programmers developed a MODULAR CLASS STRUCTURE which separately stores chassis, control schemes, and other attachments. This allows us to mix and match different parts of the program to accommodate new robots.

### TeleOp Class Structure



## PRESETS

LINEAR SLIDE - Three preset positions corresponding to the heights of the three tiers of the Alliance Shipping Hub

MAGNET ARM - Three preset positions: one for picking up blocks, one for delivering them, and one for capping with our TSE

## LIGHTS

We programmed lights on the robot to communicate information to the drivers

TIME INDICATORS - Colors change to indicate time left in match  
 FORWARD AND REVERSE LIGHTS - Colors change depending on whether the robot is in forward or reverse mode

CARGO DELIVERY INDICATORS - Lights change color if there is freight in the bucket (by using a color sensor) and when magnet is on

We use SEGMENTS, collections of methods which run via a linked list, which help to program actions such as moving forward a set distance or sensing the TSE. Each segment can be equipped with specific and unique parameters passed in through each method. This makes the autonomous code easier to adjust and develop quickly

```

atsNextSegment = atsCurrentSegment;

atsNewSegment = new AutonomousStrafeSidewaysSegment( distToTravel: -17, dblDesiredHeading: 0,
atsNextSegment.setNextSegment(atsNewSegment);
atsNextSegment = atsNewSegment;

atsNewSegment = new AutonomousStrafeForwardSegment( distToTravel: 11, dblDesiredHeading: 0,
atsNextSegment.setNextSegment(atsNewSegment);
atsNextSegment = atsNewSegment;
    
```

