Summary Page

Team Introduction

Mt. Carmel High School's Team 5135 was founded in 2011, and the team is currently participating in its **seventh season** with the FIRST Tech Challenge. Our club has since grown so large that we had to create a sister team during the 2016-17 season, FTC 11285 PATENT PENDING.

Our team is dedicated to providing a fun and educational experience for all of our members and aims to **promote the STEM fields through community outreach events**. We **focus on education** with members teaching each other essential skills including, but not limited to, budgeting, programming, CAD, building, and even graphic design.

This is our first season that we have approached with a **CAD-first workflow** and the result is a robot with **seamless custom designed parts**, featuring 3D printed buckets that are over a foot long.

This season was not without challenges and difficult decisions, but highlights include a **collection and scoring subsystem redesign in only twenty hours,** exhibition at Maker Faire San Diego, and a Finalist Alliance finish at our third league meet.

We would also like to extend our thanks to Team 4042, Nonstandard Deviation for supplying us with their Engineering Notebook which served as inspiration for our notebook format.

Notable Pages

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2018-19 Engineering Notebook

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Team Member Profiles

Noah Truong

Programming	Build	Design

Team Captain, Design Lead, and Primary Driver

Noah Truong has been a part of Team Uncopyrightable ever since he joined the club during FIRST Res-Q (2015/2016). He serves as one of two team captains, leads the Design Team, and also holds the administrative position of President. Outside of robotics, his numerous hobbies have led others to question his sanity. Noah enjoys rock climbing, mountain biking, selling sneakers, building 3D printers, and solving Rubik's Cubes. He decided to join an FTC team because he felt it was the natural progression from FLL, which he participated in during his middle school years.

Ronin Bhandare

Programming	Build	Design

Team Captain

Ronin Bhandare is a senior at Mt. Carmel High School and this is his second year on Team Uncopyrightable. His experience is with the Build Team. Outside of robotics, he enjoys playing drums with his band and working on his project 1999 Mazda Miata. Additionally, he distracts himself from a stressful school schedule with running, rock climbing, and mountain biking when he can. Bhandare joined robotics because he wanted to get more Mechanical Engineering experience.

Jay Buensuceso

Programming	Build	Design

Documentation Lead & Subsystems Driver

Jay Buensuceso is currently a senior at Mt. Carmel High School. This is his second year in robotics and he is the current secretary of the club. Within 5135, he works on the engineering notebook, builds the robot, and is the subsystems driver during competition. Outside of robotics, he has many interest and hobbies, including graphic design, rock climbing, and rocketry. He joined FTC because it teaches him the skills necessary for a career in STEM.

Alex Demange

Programming	Build	Design

Build Lead & Coach

Alex Demange is a senior and is in his fourth year of robotics. He is the build lead, ensures the robot fits in the size limit, and manages the electronics. He joined robotics in order to further his knowledge in the STEM field. He enjoys doing mathematics and science, and is interested in pursuing a degree in engineering. During his free time, he enjoys hanging out with friends and playing video games.

Nathan Van Lingen

Programming	Build	Design

Programming Lead & Finance Lead

Nathan Van Lingen is currently a senior at Mt. Carmel. This is his fourth year in FTC. He is the treasurer and programming lead, working closely with his teammates to make sure both the budget is balanced and the code is running smoothly. He first joined FIRST in middle school where he competed in FLL for two years. In his free time, he enjoys programming, playing piano, and playing video games.

Jayden Sibley

Programming	Build	Design

Programmer, Builder, & Outreach Lead

Jayden Sibley is currently a senior at Mt. Carmel. This is his third year on the robotics team. He is the head of outreach and the co-vice president. Outside of robotics, Jayden is a great french horn player, earning a spot in the highest honor band in Southern California. He also volunteers often at his church as an usher and sound tech. In college, he plans to major in music technology. He joined robotics to make friends and learn more about engineering. He is confident he has accomplished both.

Enrique Bustamante

Programming	Build	Design

Programmer

Enrique Bustamante is a senior at Mt. Carmel. This is his first year on the robotics team, but he has always had a passion for programming. He enjoys helping others by providing programming and design ideas. During his free time, he enjoys listening to music and chatting with friends. Enrique joined robotics in order to get coding experience and use his current knowledge of code into action.

Michinori Wada

Programming	Build	Design

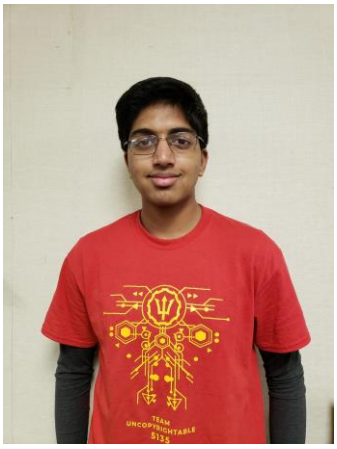
Programmer

Michinori Wada is a sophomore at Mt. Carmel High School. This is his second year in robotics. He joined 5135 because he has had an interest in the STEM Field, and has participated in the FLL in elementary school for Rolling Hills Elementary School. He enjoys reading in his free time.

Pranav Mekkoth

Programming	Build	Design

Programmer



Pranav Mekkoth is a sophomore in Mount Carmel High School. This is his first year as a programer in the robotics club. He enjoys playing basketball and playing video games. Outside of robotics, he has many interests. This includes making video games, cooking, playing basketball, snowboarding, and surfing. Pranav joined robotics because he felt that it would help him improve his coding skills and help him get a job in getting a job in a STEM field.

Kobe Maigue

Programming	Build	Design

Programmer

Kobe Maigue is a sophomore in Mount Carmel High School. This is his first year as a programmer in the robotics club. He loves drawing, playing video games, and listening to music. Outside robotics, he is a member of Friendship Club. His favorite subject is math. He's interested in programming and is from the Philippines.

Sholehani Hafezi

Programming	Build	Design

Programmer

Sholehani Hafezi is a junior at Mt. Carmel High School. This is her first year in the robotics club. She has interests in programming and uses robotics to help expand her knowledge. Her hobbies include community service, baking, and playing video games.

Annapurna Saladi

Programming	Build	Design

Programmer

Annapurna Saladi is freshman at Mt. Carmel. This is her first year in the robotics club. Outside of robotics she is a part of Science Olympiad and Academic League. Some of her hobbies are drawing and reading. Annapurna joined robotics because it would help her in her future when getting a job in the STEM field.

Tanner Whitfield

Programming	Build	Design

Builder

Tanner Whitfield is a senior at Mt. Carmel High School. He has joined robotics to familiarize himself with the complications of building and designing a robot. Outside of robotics, he is part of rock climbing club, and plans to major in engineering.

Olivia Milas

Programming	Build	Design

Builder

Olivia Milas is a senior at Mt Carmel High School. She has recently moved from Minnesota and this is her first year on Team Uncopyrightable. Outside of school she likes to play games like Civ 6 and EU4. Olivia joined the robotics team because last year she was previously on another FTC Team, 6147, while she lived in Minnesota.

Gloria Martinez

Programming	Build	Design

Builder & Spirit Lead

Gloria Martinez is currently a junior at Mt. Carmel. It is her first year on the robotics team. Gloria decided to join robotics because she had an interest in STEM and was curious about what the robotics club did. She is a huge Packers fan and is quite the avid gamer with her favorite video game being Fortnite.

Samantha Stampfl

Programming	Build	Design

Designer

Samantha is a junior at Mt. Carmel High School. This is her first year in robotics. She enjoys baking, painting, and playing piano. She joined robotics because she is interested in mechanical engineering and design.

Sherry Tao

Programming	Build	Design

Designer

	Sherry is a junior at Mt. Carmel High School. This is her first year in robotics. Outside of robotics, she enjoys arts and crafts, video games, and playing flute. She is interested in mechanical engineering and physics. She joined robotics because of friends in the club and her interest in pursuing a career in STEM.

Team Sponsors

We would like to extend our sincere thanks to our generous sponsors, without whom our season would not have been possible.

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2018 - 2019 Business Plan

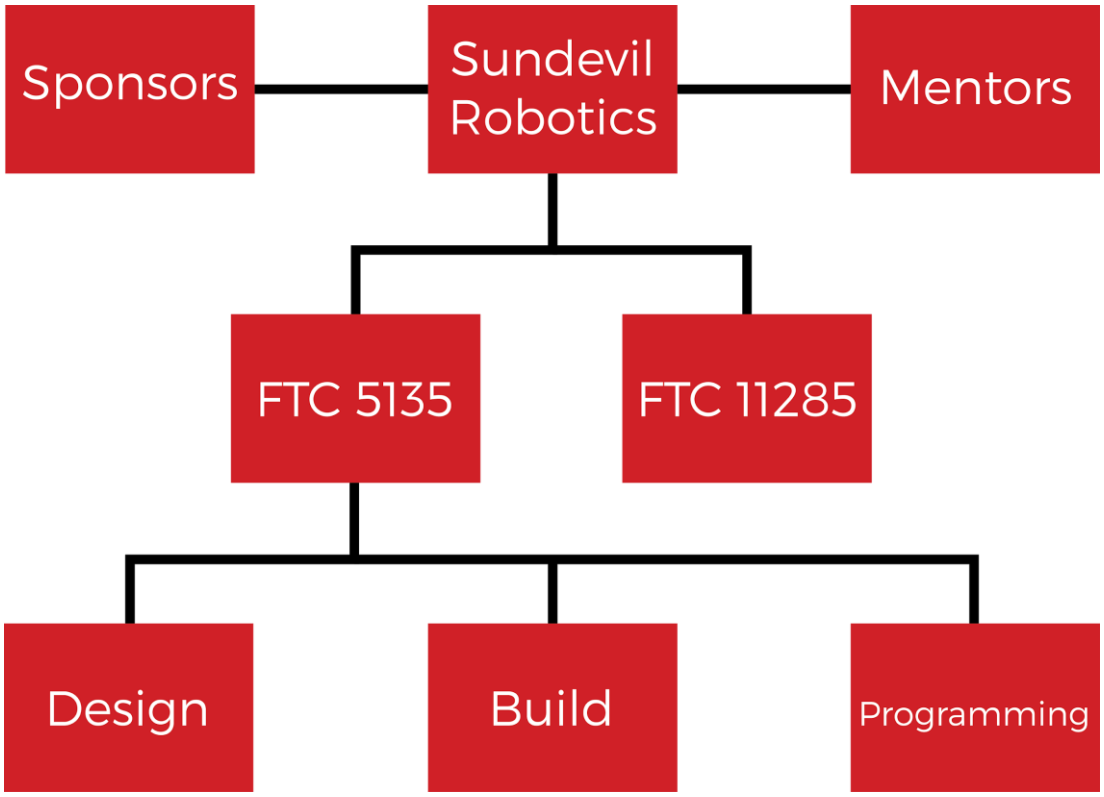
Team Organization

Our team is headed by two team captains and is split into three sub-teams called Design, Build, and Programming. The people in charge of these three sub-teams are selected by the team captains, who are appointed by our mentors. Along with these leadership positions, other team members also have designations such as Outreach Lead or Documentation Lead.

Roles

Captains: Noah Truong and Ronin Bhandare		
Design Lead: Noah Truong	**Build Lead: Alex Demange**	**Programming Lead: Nathan Van Lingen**
Sherry Tao Samantha Stampfl	Olivia Milas Jayden Sibley Gloria Martinez Jay Buensuceso Ronin Bhandare Tanner Whitfield	Kobe Maigue Jayden Sibley Michinori Wada Pranav Mekkoth Sholehani Hafezi Annapurna Saladi Enrique Bustamante

Organization



Responsibilities

Robot Roles	
Team Captains: Noah Truong Ronin Bhandare	Our team captains' primary goals are to ensure that everyone is productive and able to work together in order to succeed in a team based environment.
Design Lead: Noah Truong	As Design Lead, Noah coordinates with members of the design team to make sure that the CAD for the robot and its subsystems are complete to be ready for handoff to the builders.
Build Lead: Alex Demange	Alex's responsibilities as build lead include teaching proper building methods, ensuring deadlines are met, and the robot is structurally sound.
Programming Lead: Nathan Van Lingen	As Programming Lead, Nathan teaches the members of the design team Java through block programming and Android Studio. He also works to make sure the Driver Control and Autonomous code are ready for testing.
Miscellaneous Roles	

Documentation Lead: Jay Buensuceso	The Documentation Lead is responsible for all things notebook. Jay works to take pictures of all meetings and coordinates other members of 5135 to ensure that the notebook is detailed and accurate.
Outreach Lead: Jayden Sibley	Jayden helps to coordinate community outreach events. With these events, he aims to promote FIRST and STEM within our local community.
Finance Lead: Nathan Van Lingen	As club treasurer, Nathan works to balance the budgets of both the club as well as our team.
Spirit Lead: Gloria Martinez	Attaining this role by being our team's #1 fan, Gloria is the Spirit Lead which means she is responsible for promotional content as well as leading the team in cheer during matches.

Goals

Team Goals

To provide a fun and educational experience for all of our members and aim to **promote the STEM fields through community outreach events**. **Focus on education** with members teaching each other essential skills including, but not limited to budgeting, programming, CAD, building, and even graphic design.

Short Term Goals:

Adopt a CAD-first workflow
Teach new members CAD (Computer Aided Drafting) in Autodesk Inventor
Use block programming, Coding Bat, and Android Studio to teach new members Java
Increase driver training and testing time over previous seasons

Long Term Goals:

Participate in more community outreach events
Assist more teams in the design process
Enable and encourage other teams to test their robots by making our field available to them
Qualify for the San Diego Regional Competition

Design Goals:

Use Autodesk Inventor to create a full CAD model of the robot before beginning assembly
Make use of resources available to us (3D printers, laser cutter, etc.)
Design custom parts for seamless integration into robot
Constantly improve design through testing

Build Goals:

Fully assemble the robot with a short deadline
Follow better building practices to ensure the safety of members
Ensure entire robot is structurally sound and ready for competition
Assign 2-3 members per subsystem for the duration of the season

Programming Goals:

Teach new members Java (severe lack of returning programmers for next season)
Implement machine vision for Autonomous
Use functions to smooth driver controls
Document Code and use GitHub for project management

SWOT Analysis

(Strengths Weaknesses Opportunities Threats)

Our SWOT analysis considers all the strengths and weaknesses of our team for the 2018-2019 Rover Ruckus season.

Strengths	Weaknesses

Large team
  Multiple members available to complete tasks simultaneously
Members and Mentors
  Experienced members and FTC Alumni as mentors
  Former HP Engineer and current Engineering Teacher as mentor
	Harder to manage large team
	  Two team captains needed to ensure productivity
	Shorter and less frequent meetings
	  Only 5 hours a week compared to other teams who meet 10+ hours

Opportunities	**Threats**
Sponsorships Form Factories, Nordson, Daily.co, team parents Outreach with STEM events (MakerFaire, local science fairs, etc.)	Small design team Lack of multiple experienced programmers

Engineering Connections

Throughout the season we had the opportunity to reach out to real-world engineers for guidance on certain parts of our notebooks. During the design process we consulted with our new sponsor FormFactories on the various types of materials we can use for the 3D printed components of our robots. Furthermore, one of our mentors works at Space and Naval Warfare Systems Command (SPAWAR) and he provided guidance throughout the 2018-2019 season. Our club advisor is also a former employee of Hewlett-Packard and provided guidance on the engineering process.

Timeline

February - May 2018 - Intermural Competition within club and with BMMS Robotics.

April 26, 2018 - PUSD CTE Expo at Petco Headquarters

August 28, 2018 - First Robotics Club meeting for returning members

August 29, 2018 - Informational meeting during school for recruiting new members

September 8, 2018 - Rover Ruckus Kickoff

October 6 & 7, 2018 - San Diego Maker Faire in Balboa Park

October 9, 2018 - *Preliminary Design Review*

October 19, 2018 - MCHS GirlUp STEM Event

December 1 2018 - STEAM Maker Festival Scrimmage

December 8, 2018 - League Meet 1

December 11, 2018 - *Critical Design Review*

December 19, 2018 - Visit/Volunteer at FormFactories

January 12, 2019 - League Meet 2

January 26, 2019 - League Meet 3

February 8, 2019 - BMMS 6th Grade Event

February 10, 2019 - Descartes League Championships

March 3, 2018 - San Diego Regionals

Budget

Club Expenses				
Item	**Cost**	**Qty**	**Total**	**Explanation**
FTC Registration	$300	2	$600	Registration fees for FIRST Tech Challenge
FTC San Diego Regional Registration	$250	2	$500	Registration fees for San Diego Regional FTC
RR Field	$515	1	$790	Field for the 2018-2019 FTC season
Laptops	$140	10	$1400	For programming, design, and business
3D Printers	$275	2	$550	Monoprice Select Mini 3D Printers to 3D print small items during meeting
Robot Parts	$1100	N/A	$1100	Various materials, cables, and robot components.
Total			**$4318**	

Club Revenue		
Item	**Amount**	**Explanation**
Rollover	$4479	Amount left from last season
Sponsorships	$5200	Financial Contributions from Corporations
Personal Donations	$1040	Financial Contributions from individuals such as team members, families, or friends.
Maker Faire	$78	Amount raised at Maker Faire
Total	**$10797**	

Fundraising

Maker Faire

Every year, our club prepares a booth at San Diego Maker Faire where we show people what it means to be an engineer and to be a part of FIRST robotics. We set up a donation box in exchange for 3D printed keychains for any passersby and raised $78.

Sponsorships

Last year, we received several substantial grants from generous companies, consisting of **$5000 from Nordson, $100 from EnviroSolve, and $100 from Daily.co.** Additionally, local 3D printing company, FormFactories provided us with 3D printed parts.

Personal Donations

We don't require payment from any of our members or their families, but we do ask for any donations if possible. These incredibly generous parents and families donated a total of $1040.

Restaurants

In collaboration with several local restaurants such as Wings N Things and Chipotle, our club holds fundraisers where 20 to 50 percent of sales from a specific date is donated to our team.

Sustainability Plan

As a seven year old team we hope to continue a tradition of robotics in our school club. Currently almost half of our team members are seniors and a large majority of them hold key positions in the club which has the potential to create issues when they graduate. As a team however, we are committed to taking the steps to ensure that we will continue to be successful even after this season.

Education:

Our club is dedicated to teaching new members the skills they have learned from older members in the past. So far members have participated in lessons including programming, 3D printing, CAD, and building. Throughout the season our captains take steps to ensure that they are not only working on the robot but also instructing younger members and explaining every step in the process. Additionally our captains' focus on delegation make sure that other members get hands-on experience.

Intramural Competition:

In addition to educating younger members throughout the season, we spend the offseason participating in an Intramural Competition FTC-style robot game designed by our wonderful mentors. We split our school club into 2-4 teams and also invite some local teams. This competition allows the younger members to become leaders of their own teams and serves as training and practice. This allows graduating members to step back and simply offer their advice.

Recruitment:

Our team has the advantage of being linked to our school as a school club. This means that we can get members through advertisements in schools, promotion in STEM classes, and also club rush events during school. One of our mentors is the teacher for the Engineering courses offered at our school and we have found that to be a great source of members. In the longer term, we aim to inspire children in our community to join FIRST at an early age which will eventually pay off as they graduate through First Lego League into First Tech Challenge.

Fundraising:

In addition to our already established connections with local companies like Nordson, our team holds multiple fundraisers throughout the year. We also partner up with local restaurants that donate a percentage of proceeds on a specific night to our club.

Legacy:

As a fairly experienced team, we have established several community contacts within our region. We have a sizeable social media following on Twitter and we are active in a large FTC online discussion group. Furthermore, we hope that our success at events this year will raise morale and inspire continuing members to continue to do well in future seasons.

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2018 - 2019 Outreach

Outreach Summary

Goal: Increase interest in STEM-related fields and FIRST.

Events:

PUSD CTE Expo @ Petco Headquarters
April 26, 2018

2018 Maker Faire San Diego
October 6 & 7, 2018

MCHS GirlUp STEM Event
October 19, 2018

FormFactories Visit
December 19, 2018

MCHS Theatre and Drama *Dead on Arrival*
January 17, 2019

BMMS 6th Graders
February 8, 2019

BMMS Robotics
2017 - Present

PUSD CTE Expo @ Petco Headquarters
April 26, 2018

Our team was invited to participate in an event that showcased Poway Unified School District's Career Technical Education programs. District officials visited the booths of all the various programs throughout PUSD such as Poway High School's FRC team. In our booth, we showcased our outreach robots and how FIRST's programs have benefited our STEM program.

2018 Maker Faire @ Balboa Park
October 6 & 7, 2018

For the third year in a row, we showcased our robotics program at Maker Faire San Diego. Our team set up our outreach field and allowed aspiring STEM students and their parents to drive around and put balls in a goal. We also had a booth where we had great conversations with attendees about FIRST and the multiple programs that they offer. We also had the chance to converse with other teams about their progress in Rover Ruckus.

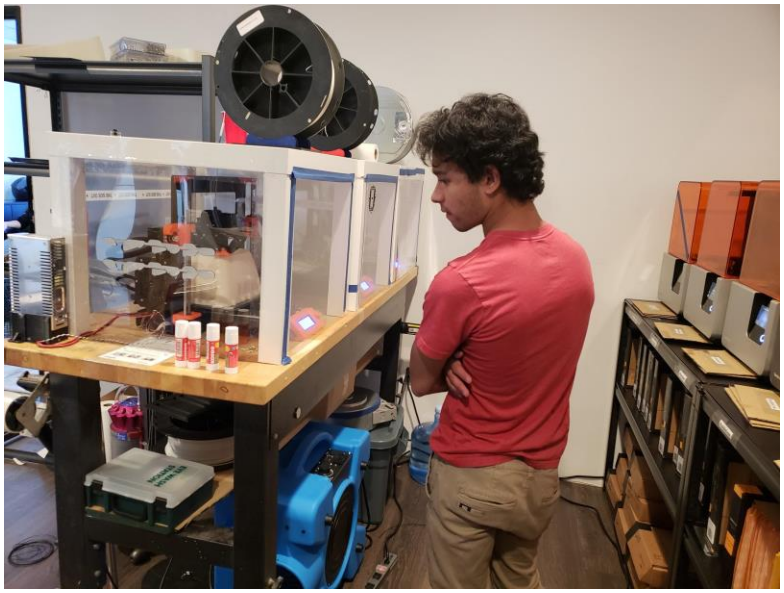
MCHS GirlUp Girl Talk STEM Event

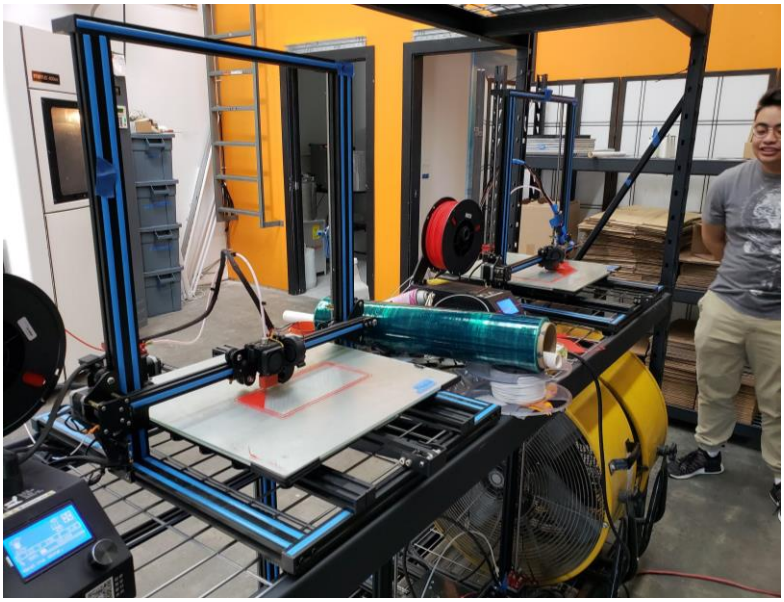
October 19, 2018

At MCHS GirlUp's first annual GirlTalk event on inspiring women in STEM, we showcased our outreach robots. We taught everyone how to drive the outreach robots and we talked to people at the event about FIRST robotics and the importance of STEM.

FormFactories Visit
December 19, 2018

As FormFactories is one of our newest sponsors this year, we decided to visit their facility to view the printing of our new front and rear buckets for Robot V2. We also assisted in maintaining their Creality CR10 S4 3D printers. Overall our members learned valuable information about the 3D printing process. Their impressive facilities include 10 large format Stratasys 3D printers, 25+ prosumer grade FFF 3D printers, and 8 Formlabs Form 2 SLA 3D printers.





MCHS Theatre and Drama *Dead on Arrival*
January 17, 2019

As a teacher assistant for the engineering class, one of our team captains, Noah Truong, met a student in Theatre Tech that needed scale models of the new set for the play they were producing, called *Dead on Arrival*. Our team was able to create 5 scale models of an essential set piece, referred to as “The Beast” These models aided the students in Theatre Tech with visualizing the set while planning out the play. We have established a relationship with the performing arts department and introduced them to the value of STEM based tools in the real world. We hope to continue this relationship with them and be a part of their esteemed program.

Black Mountain Middle School 6th Grade Camp Alternative
February 8, 2019

Our club partnered with Black Mountain Middle School's FTC teams and ran an event that showcased various robotics activities for the 6th graders who chose not to go to 6th grade camp. These activities included driving the outreach robots, creating paper circuits, and a 3D printing presentation. We also had a chance to showcase our robotics club and show the 6th graders the various STEM opportunities they have access to in high school.

Black Mountain Middle School Robotics
2017 - Present

After helping them to establish their two FTC teams last season, we continued to support Black Mountain Middle School Robotics by opening up the usage of our practice field so they can test their autonomous programs, as well as perform driver training. Along with this, we occasionally provide assistance and partner up for outreach events, including Maker Faire San Diego and the BMMS 6th Grader Event.

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2018 - 2019 Design and Engineering Overview

Initial Strategic Overview

This is our initial strategy that we brainstormed after kickoff. Our future strategies stem off of this initial plan.

Autonomous Period

Starts on Side 1 (Depot Side) or Side 2 (Crater Side), latched on the lander.
If the robot starts on Side 1 (Depot Side)
- Land using our lifting mechanism
- Sample minerals
- Claim depot
- 70 points possible

If the robot starts on Side 2 (Crater Side)
- Land using our lifting mechanism
- Sample minerals
- Park in crater
- 65 points possible

Driver Controlled Period

Collect minerals and put them in the respective cargo holds of the lander
Focus on Silver if on crater side, Gold if on depot side

End Game Period

Continue scoring minerals until ~15 seconds remaining
Latch onto the lander with lifting mechanism used for scoring

Reasoning

We chose to go with this initial strategy because we felt that it was the most consistent strategy we can realistically do. We plan to start by focusing on sampling and parking, and as the season goes on, slowly add more objectives like landing and claiming until we have satisfied our initial goals.

For reference and convenience, below is the summary table of the points available in each time period of gameplay:

Point Summary Table			
Objective	**Auto Points**	**Tele-op Points**	**End Game Points**
Robot			
Landing	30	-	-
Claiming	15	-	-
Parking	10	-	-
Sampling	25	-	-
Latching	-	-	50
Robot In Crater	-	-	15
Robot Entirely in Crater	-	-	25
Mineral			
Depot	2	2	2
Cargo Hold	5	5	5
Gold in Silver	-	-	-
Silver in Gold	-	-	-

Design Matrices

To kick off our design period, our team decided to make design matrices for various subsystems of our robot. This served two purposes: evaluate potential subsystems for our robot and educate new members on different types of mechanisms. These matrices only served the purpose of preliminary starting points for our robot and further decisions were made based off of testing.

Drivetrain Design Matrix

Drivetrains	Traction	Maneuverability	Weight	Size	Total
X-omni	3	8	3	2	**16**
4-wheel	5	5	5	5	**20**
6-wheel	6	4	4	4	**18**
Mecanum	4	7	2	4	**17**
Tank Treads	8	3	3	3	**17**

*10 is the best

As a team we ranked the traction, maneuverability, weight, and size of each type of drivetrain. Since we initially decided that we wanted to travel over the crater wall, we ruled out X-omni which would have difficulty traversing the wall. We also ruled out Mecanum wheels due to the newly imposed weight limit, as four mecanum wheels would weigh more than eight pounds, or almost 20% of the weight limit. As for tank treads, our previous experience with them during FIRST Res-Q was suboptimal and we learned that they have a tendency for breaking. Since we were down to the 4 and

6 wheel options, we went with a 6-wheel chassis because we knew that we were traveling over the crater wall and did not want to get beached on the topmost point.

Lifting Mechanism Design Matrix

Mechanisms	Height	Weight	Size	Total
Cascading Linear Slide	8	3	6	**17**
Cont. Linear Slide	8	3	6	**17**
Chain Lift	4	6	-	**-**
Lead Screw	4	6	-	**-**
Rack-and-Pinion	6	7	-	**-**

*10 is the best

We came to a decision as a group that the cascading and continuous linear slides were our best options. We eliminated the other options for various reasons. Chain lift was removed because we didn't have an optimal experience with using chain for our robot during Relic Recovery. Lead screw was eliminated because we lacked experience in building a lifter utilizing that system. Rack-and-Pinion was eliminated because we felt that it would not reach the optimal height we require as it doesn't have an in-build telescoping mechanism. We decided on a continuous lift because lifting a cascading linear slide would require more torque due to the cascading nature. This however, proved to be irrelevant as we found in our testing that we only needed a single stage lift.

Collection Design Matrix

Mechanisms	Speed	Reliability	Weight	Total
Flap	5	7	7	**19**
Turbine	7	6	6	**19**
Claw	4	4	4	**12**
Wheel	8	5	3	**16**
Rubber Band Intake	6	7	6	**19**

*10 is the best

First we begin by explaining the somewhat ambiguous names of our collection mechanisms. A flap collection is a servo powered flap that would hit balls into a bucket. A turbine collection is a continuous rotation or motor powered mechanism with multiple flaps that would continuously spin to collect minerals. A claw would be able to grab minerals individually. A wheel intake would make use of compliant wheels to grip the minerals and quickly spin them into a bucket. Lastly, a rubber band intake consists of a set of rubber bands mounted between two sprockets that spin quickly to grip minerals. As a team we decided that the claw was too slow to collect and the wheel intake would be too heavy. We chose the rubber band intake because

it would provide the most grip on the minerals and would also conform to the shape of the minerals ensuring fast collection.

Scoring Mechanism Design Matrix

Mechanisms	Weight	Speed	Reliability	Total
Same Lift	5	4	6	**15**
Second Lift	3	5	7	**15**
Launching (stored energy)	7	7	4	**18**
Launching (active)	6	7	3	**16**

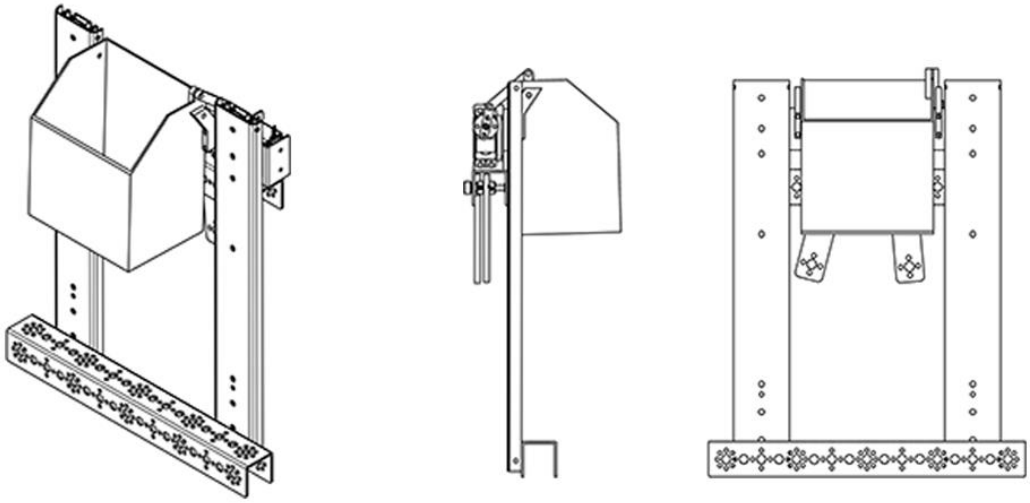
*10 is the best

After evaluating several options for the lander scoring mechanism, we had to decide between these four options. Same lift means that we would use the same lift to latch and score, and a second lift means that we would separate these two functions into two separate subsystems. While launching scored higher on the design matrix than the two lift options, our team reviewed the game manual and found that the robot had to within the landing zone to be able to launch minerals and it would therefore defeat the purpose of launching the minerals. We ended up deciding on using the same lift because we wanted to prioritize weight over speed due to the weight limit.

Version 1 "*Spirit*" Design Overview

Because of the theme of the competition and the fact that we have two different robot design iterations, we named our robots after the twin NASA Mars Exploration Rovers: Spirit and Opportunity. Spirit, our first version of the robot, acted as a test bed for the various subsystems our team chose to incorporate for Rover Ruckus. We used this platform during the San Diego Region Scrimmage as well as our first League Meet. Our dedicated design team used Autodesk Inventor to create these CAD drawings in their free time to ensure maximum productivity during meetings.

Lifting Mechanism



Single stage drawer slide lift in order to reach the height of the lander

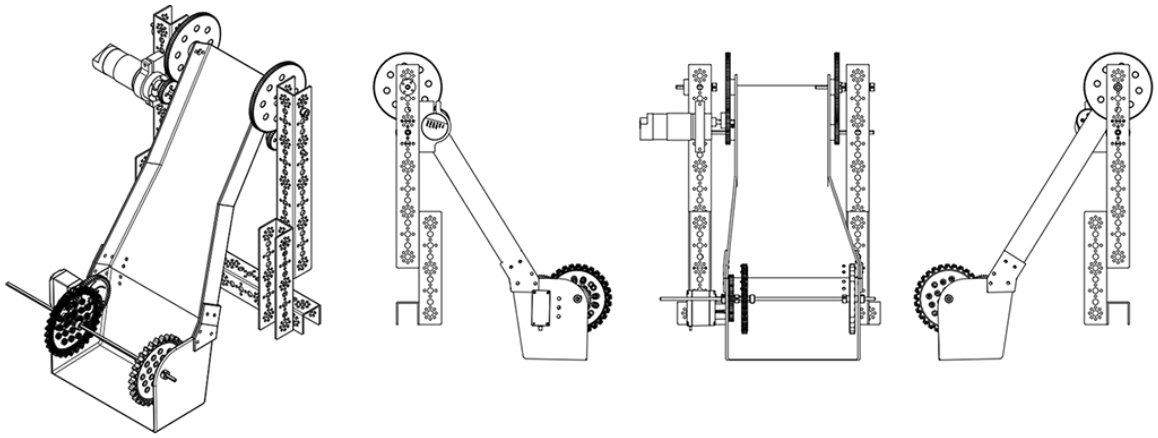
We used ultra-high-molecular-weight polyethylene cord (UHMWPE cord) as string for our pulley system because of the 300 pound max load that the string is capable of lifting.

Dual motor pulley system

The slides are powered by a pulley system utilizing one motor for each linear slide.

Four individual UHMWPE cords are used: two to lift and two to lower

Collection Mechanism



Rubber Band Intake

Two sprockets that are attached with rubber bands that spin and collect minerals through the friction of the rubber bands

Powered by VEX EDR 393 motor for fast and efficient collection

We tried a variety of gear ratios after our initial testing showed that insufficient torque cause the collection mechanism to jam

Gravity Fed Chute

Entire collection mechanism pivots in order to feed minerals into the rear bucket/final scoring mechanism

Original gear ratio speed and torque using VEX gears that we found (60:16):

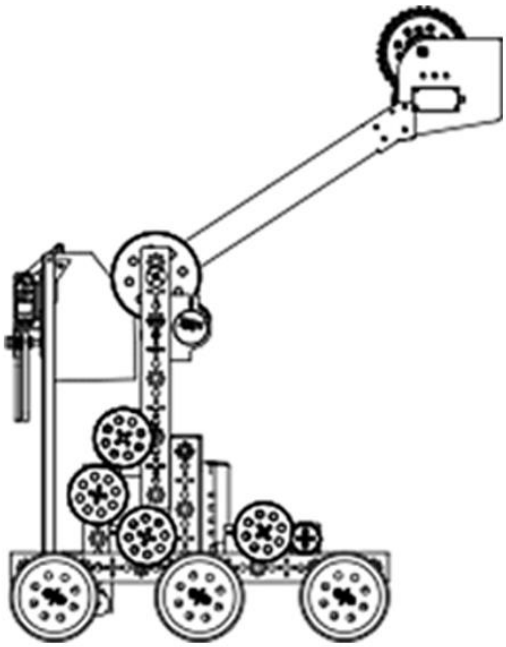
$$\omega = 100\ rpm * 5 = 500\ rpm$$
$$\tau = 1.67Nm / 5 = 0.334\ Nm$$

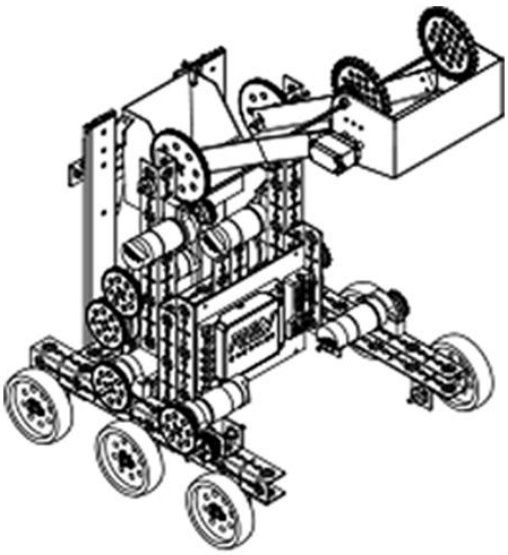
Dissatisfied with the amount of jamming due to the low torque, we tried a new gear ratio (60:36):

$$\omega = 100\ rpm * 1.667 = 166.7\ rpm$$
$$\tau = 1.67Nm / 1.667 = 1.00\ Nm$$

This proved with enough speed to collect and also enough torque to prevent jamming.

Scoring Mechanism





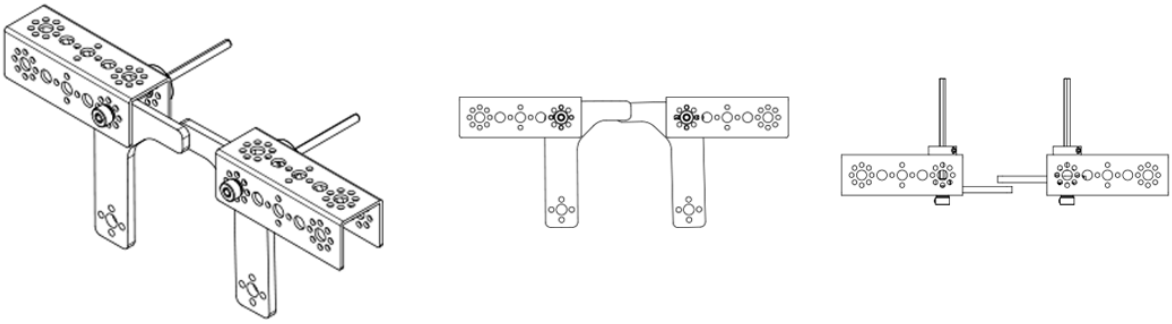
Gravity Fed Chute

Rear bucket is fed minerals through gravity chute from the collection mechanism

Rear bucket is operated by continuous rotation servo, connected by linkage

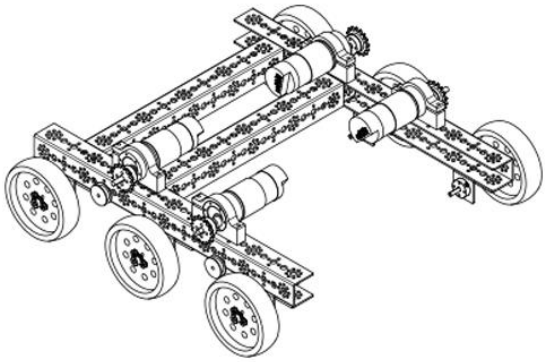
We discovered during testing that the servo has insufficient torque to operate linkage with current dimensions

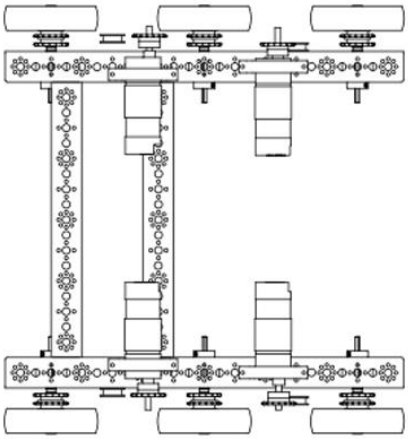
Latching Mechanism



3D printed passive latch that doesn't utilize motors or servos. It locks in place due to the force of gravity acting on the robot.

Drivetrain



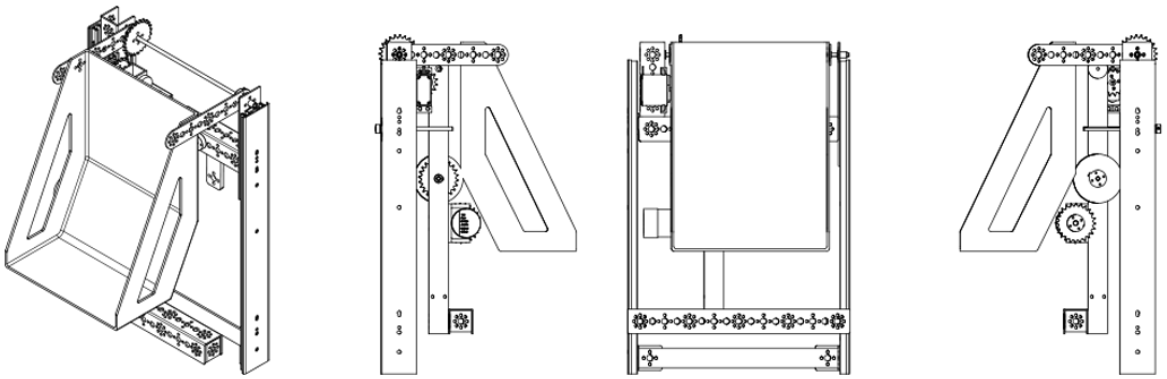


Chain linked 6-wheel drivetrain
Chain tension idlers are strategically placed in order to stop the chain from hitting the crater wall as the robot traverses it

Version 2 "*Opportunity*" Design Overview

Named after NASA's Mars Exploration Rover "Opportunity," our second version of the robot incorporated lessons we learned from *Spirit* and our robots from previous years. This is our current robot that we are using for Rover Ruckus. Again, our dedicated design team took time outside of our regular meetings to ensure the CAD model was ready for building.

Lifting Mechanism



Single-stage linear slide is still the underlying mechanism
Pulley system is again used for lifting
    New design to minimize fraying of the cord and stress on supports
UHMWPE cord is again used in conjunction with the pulley system for lifting the robot and the arm
One motor instead of the two utilized in the first robot
    Helped reduce the weight of the robot and only power from one motor was necessary to lift

After using two motors to lift the robot, our team decided to switch to only a single motor after considering the weight savings. We wanted to confirm that the lift would have enough torque with just one motor so we did some calculations

Torque calculations for robot lifting requirements (assuming 1.5” diameter spool for the UHMWPE cord)

Maximum torque applied by max weight(42lbs) robot(actual weight ~25 lbs):

$$\tau = Force * Radius = 19.05kg * 9.8\,m/s^2 * 0.01905\,m = 3.556\,Nm$$

Now that we know the maximum torque a robot can apply on a 1.5” diameter spool, we know that we only need to use a single Neverest 60 with a 1:1 gear ratio to lift the robot because it can supply up to 4.188 Nm of torque (from the manufacturer datasheets). Since we also know the maximum speed of the motor under full load, we can calculate the speed at which the lift can lower and lift.

$$V = \frac{70\,rotations}{60\,seconds} * \frac{2\pi * 0.75\,in}{1\,rotation} = 5.495\,in/second$$

We can also calculate the time it takes to lower or raise the lift each time we want to score.

$$T = 16\,in * \frac{1\,second}{5.495\,in} = 2.9\,seconds$$

After testing, however, our robot would fall down when not powered so to prevent this we elected to use a 2:3 gear ratio over a 1:1 gear ratio improving our torque.

$$\tau = Force * Radius = 19.05kg * 9.8\,m/s^2 * 0.01905\,m * \frac{3}{2} = 5.334\,Nm$$

This also changes our lift speed and therefore time.

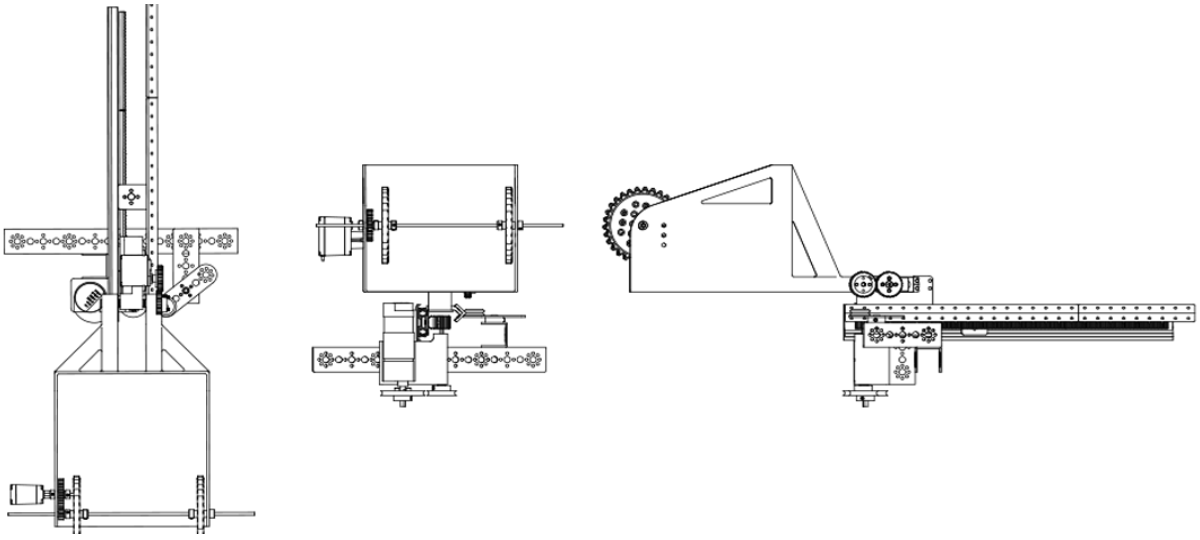
$$V = \frac{70\,rotations}{60\,seconds} * \frac{2\pi * 0.75\,in}{1\,rotation} * \frac{2}{3} = 3.663\,in/second$$

$$T = 16\,in * \frac{1\,second}{3.663\,in} = 4.36\,seconds$$

This number is when the motor is under full load and is likely faster in the real world because we are not running at full load.

After our third competition, we verified that assumption.

Collection Mechanism



Extending Collector

- Negates the need to go into the crater, which increases our scoring potential
- Added a linear slide to the center of the robot in order to extend into the crater

Redesigned Front Bucket for extending collector

Optimized the Rubber Band Intake

- New gear ratio to improve speed of collection whilst maintaining sufficient torque
- VEX EDR 393 Motor paired with Motor Controller 29 and REV Servo Power Module give us more speed than what a regular continuous rotation servo can offer.

Added Front Bucket Wrist

- Allows the robot to collect from the ground and also elevate minerals to the rear bucket for scoring in the lander

Guide Bearing

- Since we are only using a single drawer slide, the collection mechanism swayed side to side due to the design of the drawer slides. To counter this, we guide the extension arm with a pulley that is tensioned with a rubber band.

During our planning phase we initially decided to use a ¼ scale Hitec HS-755MG servo in order to power the wrist. Unfortunately due to a slight miscommunication, we did not realize that the servo was reserved for our sister team and it was too late to order another one. After searching for other servos we found that we had an extra HSR-2645CRH, which is also used on our rear bucket, which offered 138.87 oz-in of torque. To see if this is sufficient for use on the wrist, we had to calculate the maximum torque that would be exerted on the servo. We used Autodesk Inventor's analysis tools to determine that the center of mass for the bucket is 0.1165m away from the point of pivot.

$$\tau = Force * Radius = 0.4kg * 9.8m/s^2 * 0.1165m = 0.4568\,Nm$$

However, we have to also take into account the VEX components on the end of the lift, 0.2547m away for the point of pivot:

$$\tau = Force * Radius = 0.2kg * 9.8m/s^2 * 0.2547m = 0.4992\,Nm$$

We also have to consider the weight of two minerals:

$$\tau = Force * Radius = 0.1034kg * 9.8m/s^2 * 0.2547m = 0.2581\,Nm$$

All together, the maximum torque that is exerted on the servo is 1.2141 Nm or 172 oz-in. Since our servo only offers 138.87 oz-in of torque, we knew that we had to make a choice to gear up the servo or assist it in another way. In the end we decided to use a spring assist to reduce the torque on the servo. The spring counteracts the force of gravity and allows us to use the servo.

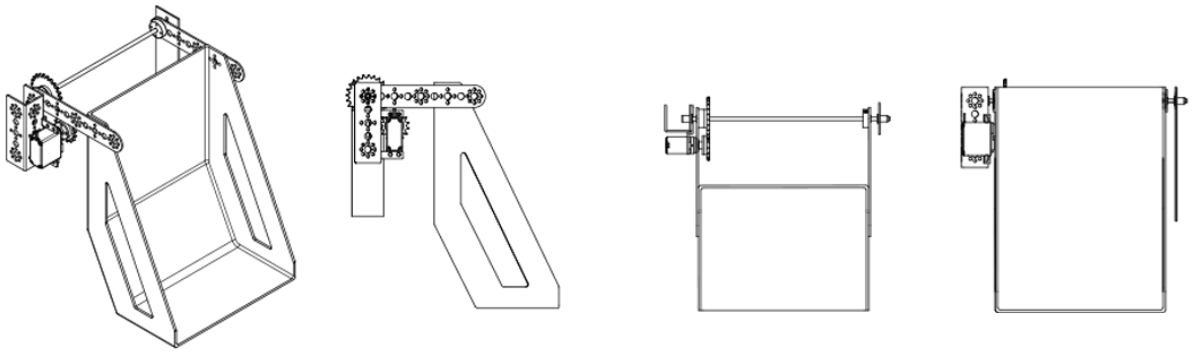
Throughout the season we tested a variety of different gear ratios for our collector in order to maintain a good balance between speed (ω) and torque (τ). To find the new speeds and torques we used these equations:

$$\omega = \omega_0 * \frac{Motor\ Gear}{Intake\ Gear} \qquad \tau = \tau_0 * \frac{Intake\ Gear}{Motor\ Gear}$$

Ratio	Speed(RPM)	Torque(Nm)	Notes
60:12 (5:1)	500	0.334	First combination we tried, not enough torque, jammed often.
36:36(1:1)	100	1.67	Collection no longer jammed but was now too slow to properly collect.

60:36(5:3)	166.67	1.002	Sufficient torque to prevent jamming but still wasn't fast enough for effective collection of the minerals.
36:12(3:1)	300	0.5566	Final gear ratio, perfect amount of torque. Fast collection without jams.

Scoring Mechanism



Redesigned Rear Bucket connected to lift
- Added elbow for ease of scoring
- Single piece design made possible by 3D printing
- Powered by Hitec HSR-2645CRH servo

During the second league meet we realized that the bucket could only lift with a single mineral in it so we decided to review the calculations.

First we estimated the center of mass and found the torque required to lift the bucket without minerals:

$$\tau = Force * Radius = 0.352kg * 9.8\,m/s^2 * 0.182m = 0.627\,Nm = 88.79\,oz\,in$$

However we still had to take into account the maximum weight of minerals, two gold, concentrated at the end of the bucket:

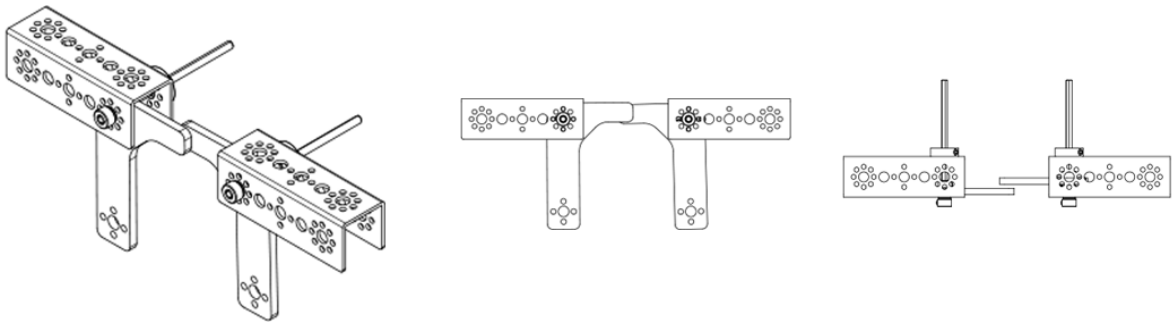
$$\tau = Force * Radius = 2 * 0.0517kg * 9.8\,m/s^2 * 0.381m = 0.387\,Nm = 54.803\,oz\,in$$

The total torque required to lift the bucket and also two gold minerals is 143.593 oz-in. Our servo can only supply 138.87 oz-in, so we had to make some changes. We decided to change the sprocket ratio from 1:1 to a 2:3 reduction.

$$\tau = 138.87\ oz\ in * \frac{3}{2} = 208.305\ oz\ in$$

After verifying these calculations we made the changes on the robot and were pleasantly surprised when the bucket worked flawlessly.

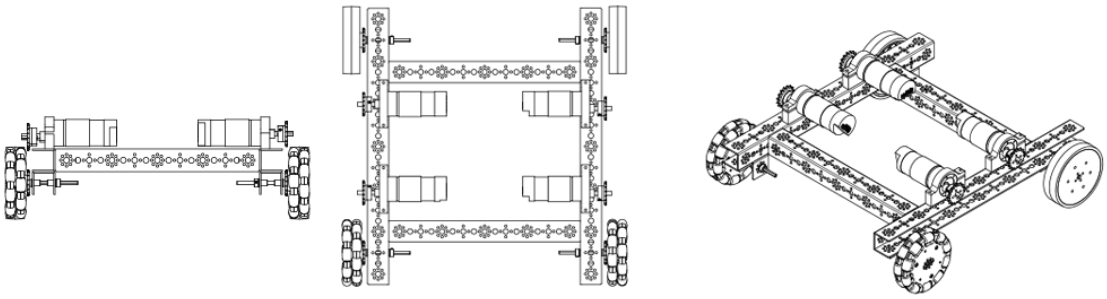
Latching Mechanism



3D Printed Passive Latch

3D printed redesigned, denser latches to improve strength and decrease flex, a recurring problem we had with the previous iteration
Same design as Robot V1 due to success during testing

Drivetrain



Reducing amount of wheels from 6 to 4

2 omni-directional wheels and 2 AndyMark Stealth Wheels to maximize grip on the field and easier pivoting

Removed idlers due to our decision to omit going into the crater and the removal of 2 center wheels

Flipped side U channels to allow for easier access to internal screws

Driving speed of our robot:

$$V = R\omega = 160\,rpm * \frac{4\,in}{1\,rotation} = 640\,in/min = 0.889\,ft/s$$

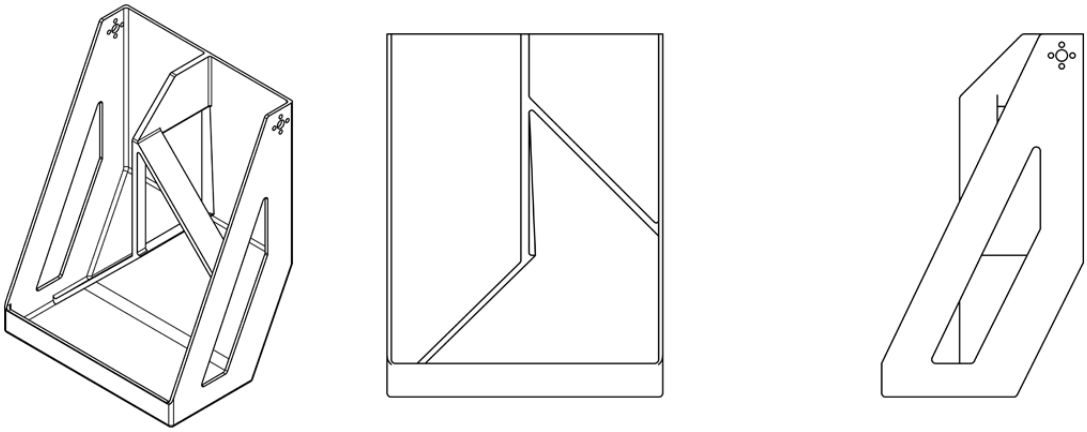
Time to drive across field:

$$T = V * d = 12\,ft * 0.889\,ft/s = 10.668s$$

Version 2.5 "*Opportunity v2*" Design Overview

Robot V2.5 is the culmination of the lessons we learned during League Championships and modifications we wanted to include on robot V2. It utilizes Version 3 subsystems on the same Version 2 platform used on *Opportunity*.

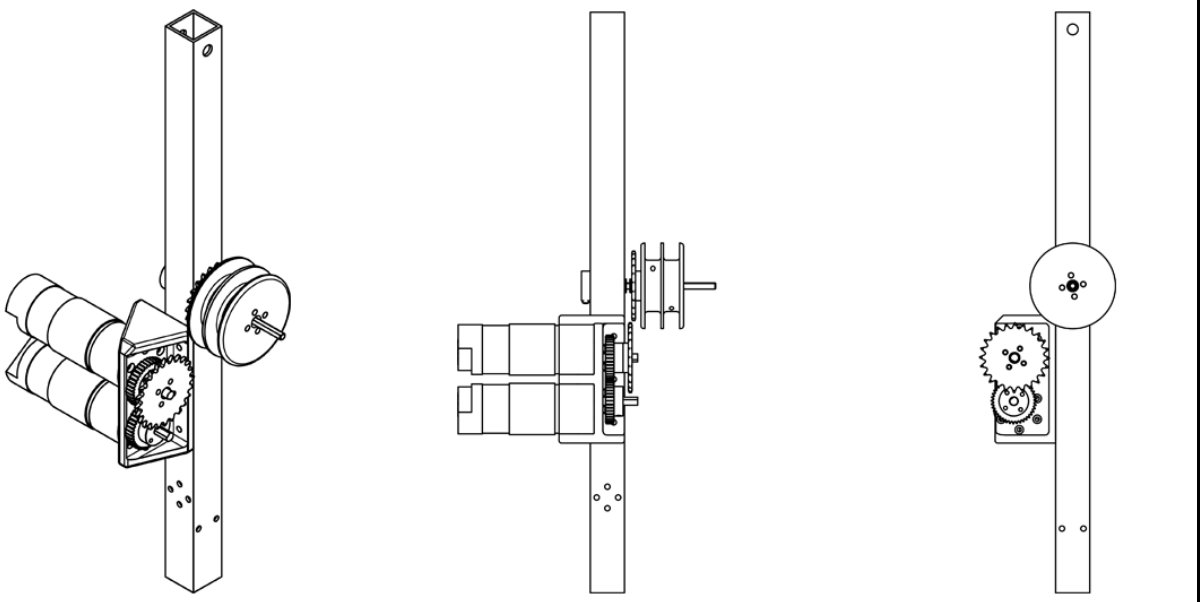
Scoring Mechanism



Redesigned Rear Bucket

- Incorporated sorter into the main bucket print
- Stratasys ABS for strength
- REV Smart Servo for increased torque and positional programming

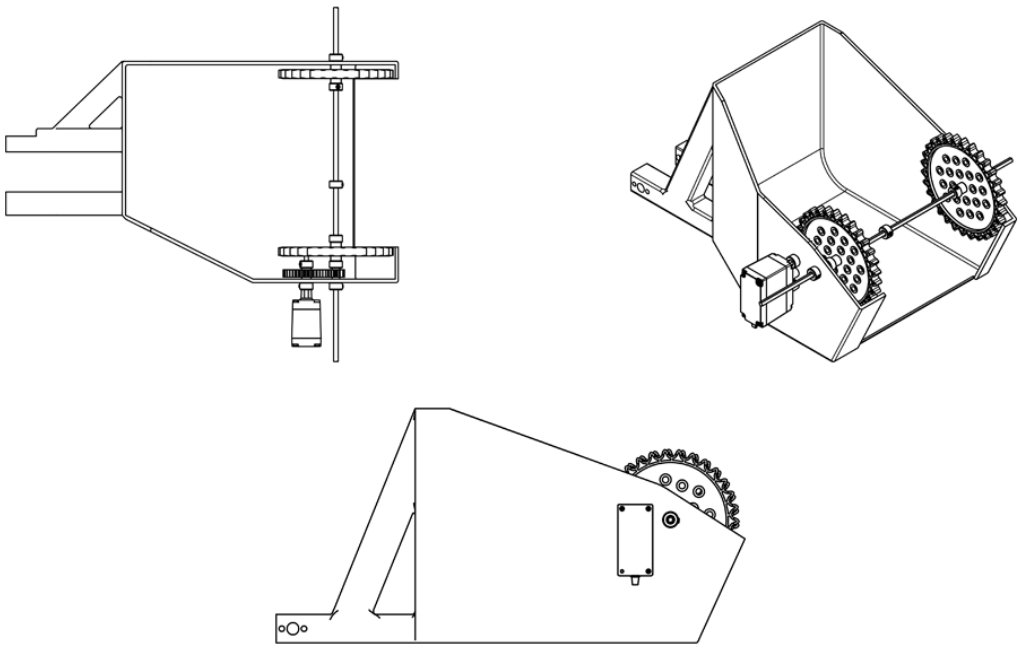
Lifting Mechanism



Double Motor Gearbox
- Switched from 60:1 with a 2:3 reduction to dual 40:1
- Doubles speed of lift

New Tensioning System
- Tensioned using I-bolts
- Enables us to tension the rope quickly

Collection Mechanism



Redesigned Bucket

Sprocket guards on front to prevent mineral jams in sprockets

Redesigned side wall to direct minerals into correct area on rear bucket

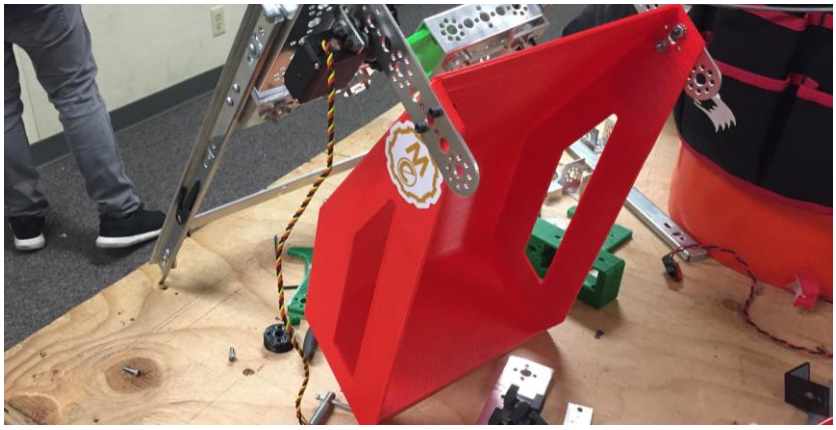
3D Printing Summary

Our CAD-first workflow this season allowed us to take advantage of custom, tailor fit 3D printed objects. These parts have been sourced from our sponsor, FormFactories, our school's own Engineering Lab, and our team captain's personal 3D printer.

Front Bucket

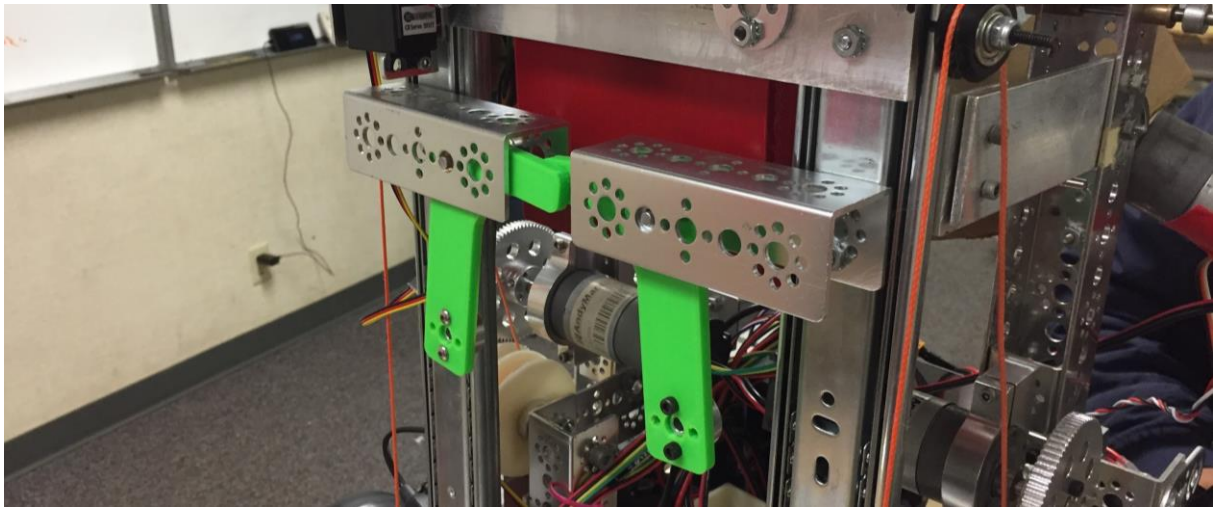
Integrated motor mount holes to accomodate for Vex EDR 393 Motor
Printed in Polylactic Acid (PLA)
- Medium strength, high stiffness
- Easy to print large parts

Rear Bucket



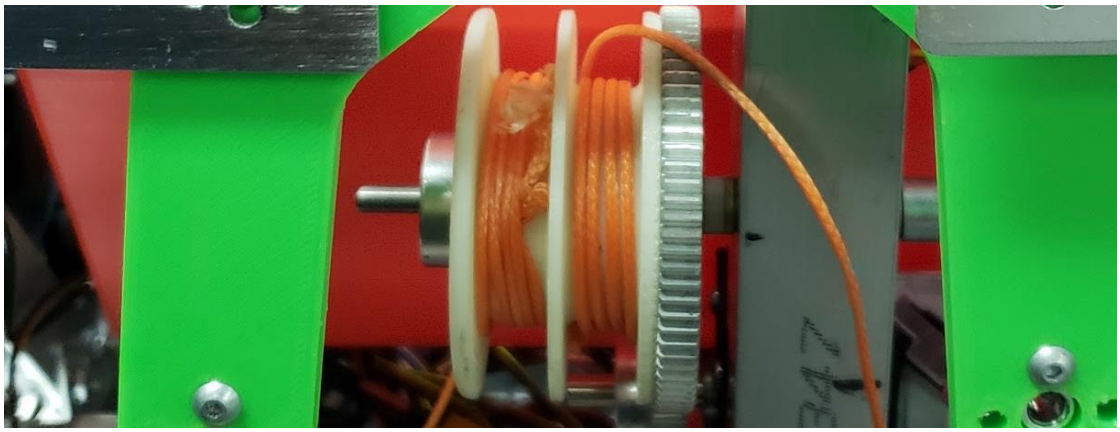
Integrated Tetrix holes to allow for easier mounting
Also printed in PLA

Latching Mechanism



Oriented for maximum strength
Printed in Polyethylene Terephthalate Glycol (PETG)
- High strength
- Tendency to flex rather than snap compared with PLA

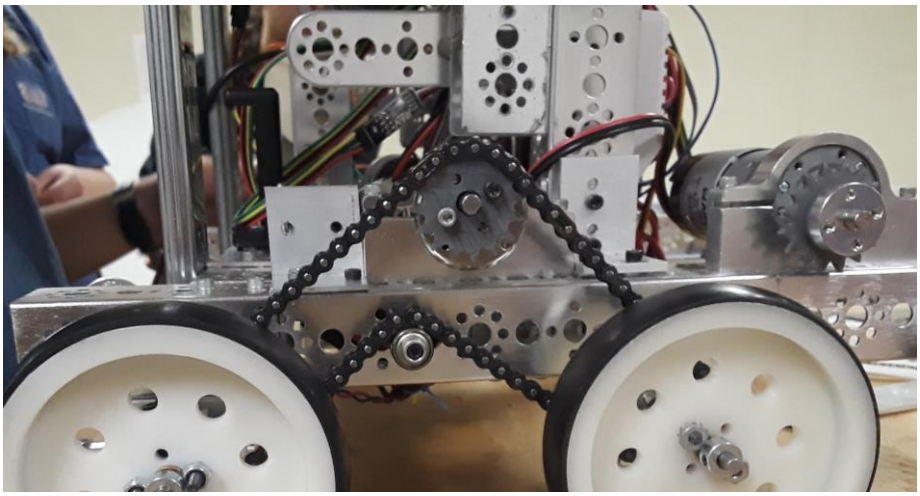
Lift Spool



Custom inner diameter to work with our robot

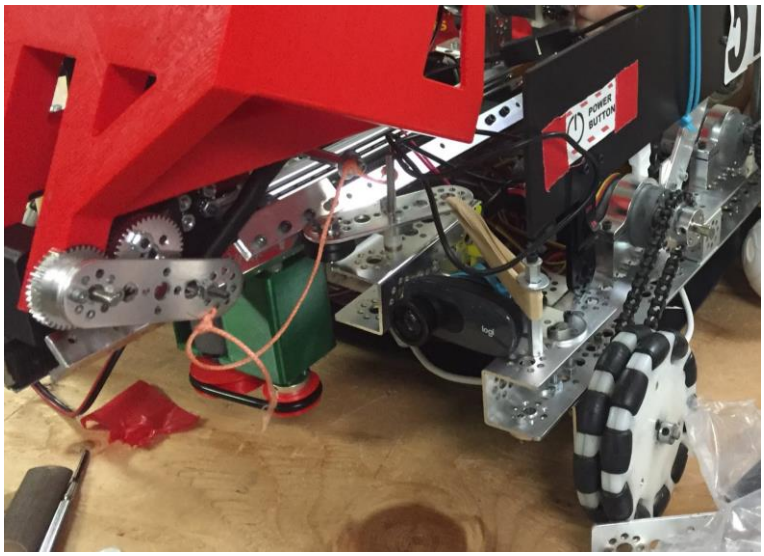
Printed in Acrylonitrile Butadiene Styrene(ABS)
- High strength
- Ability to use more complex geometries due to dissolvable support

Drivetrain Sprockets



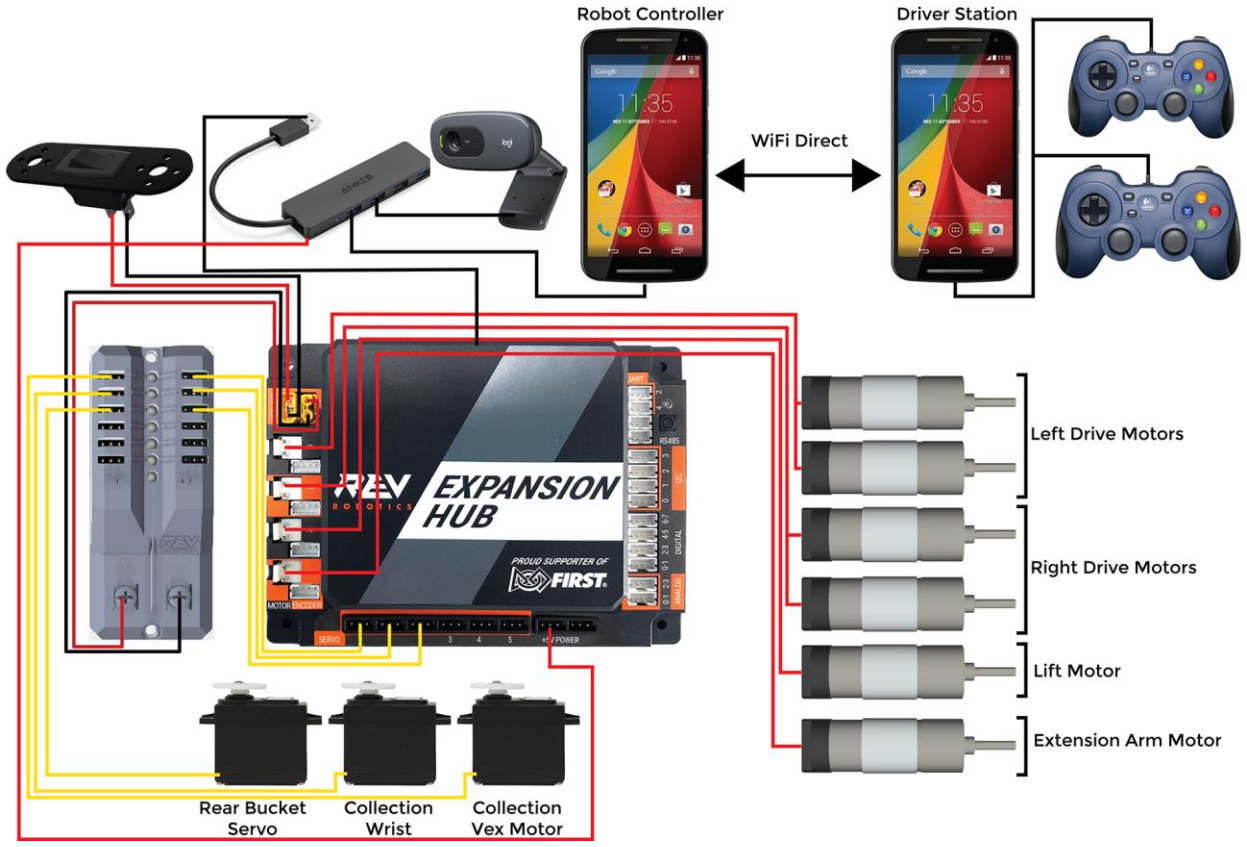
Identical geometry to Tetrix Sprockets
Initially printed in PETG using Fused Filament Fabrication (FFF)
Finally printed in Formlabs Stereolithography (SLA) Grey Pro Resin
- High resolution, precision, and strength

Extension Arm Motor Mount



Perfect custom spacing for rack and pinion mount
Printed in PETG

Robot V2 Wiring Diagram



Bill of Materials

Part Name	QTY	Part Name	QTY
16" Drawer Slide	3	Tetrix Gear 40t	2
3D printed Collection Wrist Mount	1	Tetrix Gear 80t	2
3D printed Extension Arm Pulley Large	1	Tetrix Inside L Bracket	5
3D printed Extension Arm Pulley Small	1	Tetrix Inside U Bracket	4
3D printed Front Bucket(PLA)	1	Tetrix Motor Hub	6
3D printed Latch Bar(PETG)	2	Tetrix Motor Mount	4
3D printed Rear Bucket(PLA)	1	Tetrix Omni Wheel	4
3D printed Spool(ABS)	1	Tetrix Pinion	1
3D printed Static Motor Mount(ABS)	1	Tetrix Rack	3
Andymark Stealth Wheel	2	Tetrix Set Collar	17
Assorted 6-32 screws	N/A	Tetrix Sprocket 24t	1
Electronics Plate(PVC Foam Board)	1	Tetrix Standoff 2"	2
Extension Arm Motor Mount(PETG)	1	Tetrix U Channel 288mm	2
Flat Servo Bracket	1	Tetrix U Channel 32mm	4
Hitec HSR-2645 CR	2	Tetrix U Channel 416mm	2
Lift Support Beam	2	Tetrix U Channel 96mm	4
NeveRest 20 Gearmotor	1	VEX Axle 12"	1
NeveRest 40 Gearmotor	4	VEX Axle 2"	1
NeveRest 60 Gearmotor	1	VEX EDR 393	1
Nylon Axle Spacer	5	VEX Gear 12t	1
Pulley 1"	2	VEX Gear 36t	1
Pulley Tower	1	VEX Sprocket 30t	2
Rear Bucket Mounting Bar	1		
REV Expansion Hub	1		
REV Servo Power Module	1		
Tetrix 16 Tooth Sprocket	9		
Tetrix 4.7x100mm Axle	8		
Tetrix Axle Hub	9		
Tetrix Bushing	19		
Tetrix Bushing Short	2		
Tetrix Flat 160mm	2		
Tetrix Flat L Bracket Long	1		
Tetrix Flat L Bracket Mount	1		
Tetrix Flat L Bracket Short	1		
Tetrix Flat Spacer	2		

5135
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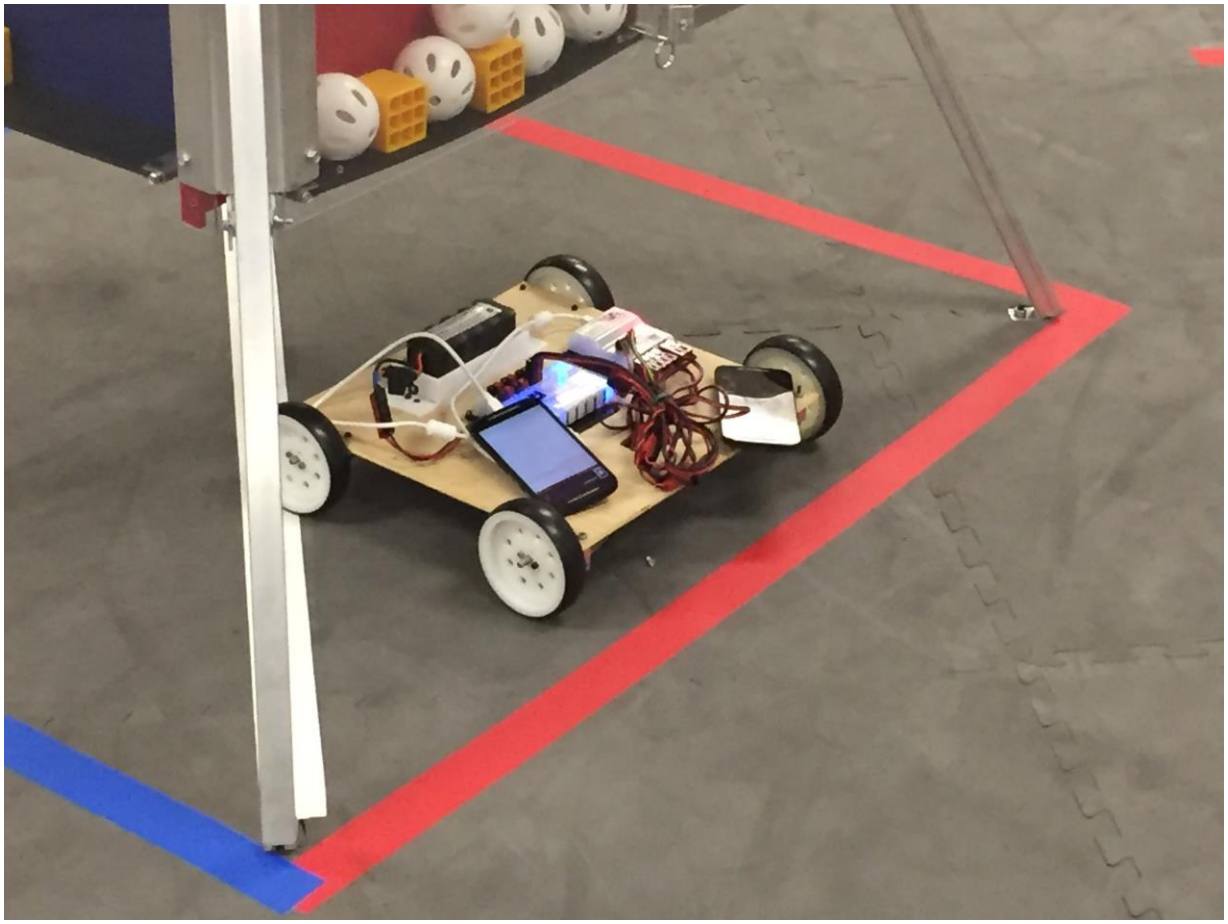
2018 - 2019 Programming

Overview

Programming Robot

In the previous seasons we had issues fitting in time to test our autonomous because the robot is being worked on by the build team. To solve this, we created a test drivetrain to allow us to work on Autonomous pathing during the build season as the build team simultaneously worked on perfecting the competition robot.



Our programming robot is, named *Pathfinder* in the same spirit as our two iterations of competition robots, *Spirit* and *Opportunity*.

Sensors

Motor Encoders

Optical motor encoders attach to the back of a motor and use slits to measure the precise amount a motor shaft has turned. They are the backbone of our autonomous strategy and programs, allowing us to consistently maneuver our robot with precision. Encoders are used in our drive system and our lift system.

USB Video Device Class(UVC) Webcam

New for the 2018-19 season, the support of UVC webcams opens up more opportunities for computer vision in FTC. UVC cameras allow us to position the robot controller phone in a safe position while still maintaining machine vision. With the help of a Logitech C270 HD Webcam, we can scan and recognize the gold and silver minerals on the field. This allows us to detect the correct position to sample minerals. We also use a fisheye lens which helps to widely increase our field of vision, as we discovered in testing that the default focus of the camera was insufficient for sampling the autonomous positions of the minerals.

Computer Vision

Computer vision is a core element to our autonomous system. We utilize computer vision through the sampling section of our autonomous mode. We employed a continuous rule-based system to find the correct mineral to remove through the use of computer vision. We use TensorFlow, a machine learning technology which is integrated into the FTC SDK and allows us to detect gold and silver minerals, as exemplified in the program below.

```
private void detect() {
       if (tfod != null) {
           // getUpdatedRecognitions() will return null if no new information is
available since
           // the last time that call was made.
           List<Recognition> updatedRecognitions = tfod.getUpdatedRecognitions();
           if (updatedRecognitions != null) {
              telemetry.addData("# Object Detected", updatedRecognitions.size());
              if (updatedRecognitions.size() == 2 || updatedRecognitions.size() == 3){
                   if(updatedRecognitions.size() == 2)
                       twoMinerals = true;
                   else
                       twoMinerals = false;
                   for (Recognition recognition : updatedRecognitions) {
                       if (recognition.getLabel().equals(LABEL_GOLD_MINERAL)) {
                           goldMineralX = (int) recognition.getLeft();
                       } else if (silverMineral1X == -1) {
                           silverMineral1X = (int) recognition.getLeft();
                       } else {
                           silverMineral2X = (int) recognition.getLeft();
                       }
                   }
                   telemetry.addData("GoldX", goldMineralX);
                   telemetry.addData("Silver1X", silverMineral1X);
                   telemetry.addData("Silver2X", silverMineral2X);
                   telemetry.update();
               }
               else {
                   goldMineralX = -1;
                   silverMineral1X = -1;
                   silverMineral2X = -1;
               }
           }
       }
}
```

Our sampling program is able to correctly decide it's path when it can see either two or three minerals. If it only sees two minerals, the path deciding logic is different from the case where it can see three minerals, so it enters a specific two-mineral sampling mode, shown below.

```
private void Sample(NormalDriveEncoders drive, Robot robot) {
   boolean twoSilver = Math.abs(silverMineral1X - silverMineral2X) < 15;
   if ((twoMinerals && !twoSilver && goldMineralX < silverMineral1X)
   || (!twoMinerals && goldMineralX < silverMineral1X && goldMineralX <
silverMineral2X))
   {
        telemetry.addData("Gold Mineral Position", "Left");
        telemetry.update();
        drive.pivotRight(45);
        drive.forward(24);
        drive.pivotLeft(30);
        drive.forward(9);
        path = 1;
   }
   else if ((twoMinerals && twoSilver)
   || (!twoMinerals && goldMineralX > silverMineral2X && goldMineralX >
silverMineral1X))
   {
        telemetry.addData("Gold Mineral Position", "Right");
        telemetry.update();
        drive.pivotLeft(45);
        drive.forward(24);
        robot.collectIn(10);
        drive.pivotRight(30);
        drive.forward(9);
        path = 3;
   }
   else {
        telemetry.addData("Gold Mineral Position", "Center");
        telemetry.update();
        drive.forward(24);
        path = 2;
   }
   telemetry.update();
}
```

Object-Oriented Programming (OOP)

With the use OOP, our code is both easy to read and work with. We created a robot class which allows us to control all of the subsystems on our robot simply by calling its assigned method. We also implemented a separate drive class that contains methods for driving forward and backward, and pivoting.

```
public class Robot {
   private DcMotor lift = null;
   private CRServo wrist = null;
   private CRServo collection = null;
   private CRServo bucket = null;
   private DcMotor extension = null;
   private NormalDriveEncoders drive = null;
   public Robot(DcMotor lift,  DcMotor extension, CRServo wrist, CRServo bucket,
                CRServo collection, NormalDriveEncoders drive) {
       this.lift = lift;
       this.extension = extension;
       this.wrist = wrist;
       this.bucket = bucket;
       this.collection = collection;
       this.drive = drive;

   }

   /**
    * Raises the lift up to unlatch the robot
    */
   public void liftUp()
   {
       lift.setTargetPosition(6800);
       while(lift.isBusy()) {
           lift.setPower(.45);
       }
       lift.setPower(0);
   }

   /**
    * Lowers the lift back to starting position
    */
   public void liftDown()
   {
       lift.setTargetPosition(0);
       while(lift.isBusy()){
           lift.setPower(-.25);
       }
       lift.setPower(0);
   }
   /**
    * Raises the wrist
    */
   public void wristUp() {
       wrist.setPower(-.8);
       try {
```

```
            Thread.sleep(500);
        } catch (InterruptedException e) {
            e.printStackTrace();
        }
        wrist.setPower(0);
    }

    public void forward(float inches) {
        drive.forward(inches);
    }

    public void pivotLeft(float degrees){
        drive.pivotLeft(degrees);
    }

    public void pivotRight(float degrees){
        drive.pivotRight(degrees);
    }

    /**
     * Lowers the wrist
     */
    public void wristDown() {
        wrist.setPower(.8);
        try {
            Thread.sleep(500);
        } catch (InterruptedException e) {
            e.printStackTrace();
        }
        wrist.setPower(0);
    }

    /**
     * Extends the front arm
     */
    public void extendOut()
    {
        extension.setPower(-.75);
        try {
            Thread.sleep(500);
        } catch (InterruptedException e) {
            e.printStackTrace();
        }
        extension.setPower(0);
    }

    /**
     * Contracts the front arm
     */
    public void extendIn()
    {
        extension.setPower(.75);
        try {
```

```
            Thread.sleep(500);
        } catch (InterruptedException e) {
            e.printStackTrace();
        }
        extension.setPower(0);
    }

    /**
     * This method collects
     * @param milliseconds
     */
    public void collectIn(int milliseconds)
    {
        collection.setPower(.8);
        try {
            Thread.sleep(milliseconds);
        } catch (InterruptedException e) {
            e.printStackTrace();
        }
        collection.setPower(0);
    }

    /**
     * Unloads whatever is inside the collector
     * @param milliseconds
     */
    public void collectOut(int milliseconds)
    {
        collection.setPower(.8);
        try {
            Thread.sleep(milliseconds);
        } catch (InterruptedException e) {
            e.printStackTrace();
        }
        collection.setPower(0);
    }

    public void bucketUp()
    {
        bucket.setPower(-8);
        try {
            Thread.sleep(500);
        } catch (InterruptedException e) {
            e.printStackTrace();
        }
        bucket.setPower(0);
    }

    public void bucketDown()
    {
        bucket.setPower(8);
        try {
            Thread.sleep(500);
        } catch (InterruptedException e) {
```

```
            e.printStackTrace();
        }
        bucket.setPower(0);
    }
}

public class NormalDriveEncoders {

    final private int encoder = 1120;
    final private float turnRadius =  17.8f;

    private DcMotor left, right;
    private Telemetry telemetry;
    private LinearOpMode opmode;
    float power;

    public NormalDriveEncoders(DcMotor left, DcMotor right, Telemetry telemetry, float
power, LinearOpMode opmode) {
        this.left = left;
        this.right = right;
        this.telemetry = telemetry;
        this.power = power;
        this.opmode = opmode;
    }

    public void forward(float in) {

        int pos = (int)((encoder * in)/(4 * Math.PI));

        left.setMode(DcMotor.RunMode.RUN_TO_POSITION);
        right.setMode(DcMotor.RunMode.RUN_TO_POSITION);
        left.setTargetPosition(pos);
        right.setTargetPosition(pos);
        right.setPower(power);
        left.setPower(power);
        while(left.isBusy() && right.isBusy() && opmode.opModeIsActive())
        {
            telemetry.addData("Motor Encoder", "Left Pos: " +
left.getCurrentPosition());
            telemetry.addLine();
            telemetry.addData("Motor Encoder", "Right Pos: " +
right.getCurrentPosition());
            telemetry.addLine();
            telemetry.addData("Power","Left Pow: " + left.getPower());
            telemetry.addLine();
            telemetry.addData("Power","Right Pow: " + right.getPower());
            telemetry.addLine();
            telemetry.addData("Target","Left Tar: " + left.getTargetPosition());
            telemetry.update();
        }
        left.setPower(0);
        right.setPower(0);
        telemetry.update();
```

```
        left.setMode(DcMotor.RunMode.STOP_AND_RESET_ENCODER);
        right.setMode(DcMotor.RunMode.STOP_AND_RESET_ENCODER);
    }
    public void backward(float in)
    {
        forward(-in);
    }
    public void pivotLeft(float degrees)

    {
        double arc = Math.PI * turnRadius * degrees / 360f;
        int pos = (int)((encoder * arc)/(4 * Math.PI));

        left.setMode(DcMotor.RunMode.RUN_TO_POSITION);
        right.setMode(DcMotor.RunMode.RUN_TO_POSITION);
        left.setTargetPosition(pos);
        right.setTargetPosition(-pos);
        left.setPower(power);
        right.setPower(power);
        while(left.isBusy() && right.isBusy() && opmode.opModeIsActive())
        {
            telemetry.addData("Motor Encoder", "Left Pos: " +
left.getCurrentPosition());
            telemetry.addLine();
            telemetry.addData("Motor Encoder", "Right Pos: " +
right.getCurrentPosition());
            telemetry.addLine();
            telemetry.addData("Power","Left Pow: " + left.getPower());
            telemetry.addLine();
            telemetry.addData("Power","Right Pow: " + right.getPower());
            telemetry.addLine();
            telemetry.addData("Target","Left Tar: " + left.getTargetPosition());
(continued on next page)

              telemetry.update();
            //telemetry.addData("Target","Right Tar: " + right.getTargetPosition());
            //telemetry.update();
        }
        left.setPower(0);
        right.setPower(0);
        left.setMode(DcMotor.RunMode.STOP_AND_RESET_ENCODER);
        right.setMode(DcMotor.RunMode.STOP_AND_RESET_ENCODER);
    }
    public void pivotRight(float degrees)
    {
       pivotLeft(-degrees);
    }
    public void setPower(float a) {power = a;}
}
```

With OOP, our actual autonomous code looks something like this:

```
NormalDriveEncoders drive = new NormalDriveEncoders(left, right, telemetry, .3f,
this);
Robot robot = new Robot(lift, extension, wrist, bucket, collection, drive);

if (tfod != null) {
   /** Activate Tensor Flow Object Detection. */
   tfod.activate();
}
while(!opModeIsActive()) {
   detect();
}
if (opModeIsActive()) {
   runtime.reset();
}

left.setMode(DcMotor.RunMode.STOP_AND_RESET_ENCODER);
right.setMode(DcMotor.RunMode.STOP_AND_RESET_ENCODER);
lift.setMode(DcMotor.RunMode.STOP_AND_RESET_ENCODER);
lift.setMode(DcMotor.RunMode.RUN_TO_POSITION);
robot.wristDown();
robot.liftUp();
drive.forward(4);
Sample(drive,robot);
robot.extendOut();
robot.wristDown();
```


Driver Control Period - Code

A major obstacle we faced while testing our teleop code was that driving was too touchy and sensitive to control with precision, so we made the driving power scale to the power of 1.8. This works because the input that the joystick returns is between -1 and 1 (-1 being fully down, 1 being fully up), as the value that the joystick returns approaches 0, the value return is scaled by the function, resulting in less sensitive controls. For example, pushing the joystick ¼ of the way up only turns the motor on 8%, but pushing the joystick all the way up will give 100%.

```
@Override
public void loop() {

   double forward =  gamepad1.left_stick_y;
   double turn = gamepad1.right_stick_x;
   double collect = gamepad2.left_trigger - gamepad2.right_trigger;
   double fBPower = gamepad2.right_stick_y;
```

```
    double wristPower = gamepad1.left_trigger - gamepad1.right_trigger;

    if(forward > 0)
        forward = Math.pow(forward, 1.8);
    else if(forward < 0)
        forward = -Math.pow(forward, 1.8);
    if(turn > 0)
        turn = Math.pow(forward, 1.8);
    else if(turn < 0)
        turn = -Math.pow(forward, 1.8);

    left.setPower(Range.clip(forward - turn, -1, 1));
    right.setPower(Range.clip(forward + turn, -1, 1));
    collection.setPower(0.8*(Range.clip(collect, -1.0, 1.0)));
    wrist.setPower(0.8*(Range.clip(wristPower, -1, 1)));

    if(gamepad2.left_stick_y >0.2)
        lift.setPower(-1);
    else if(gamepad2.left_stick_y<-0.2)
        lift.setPower(1);
    else
        lift.setPower(0);

    if (gamepad2.dpad_up)
        bucket.setPower(-.8);
    else if (gamepad2.dpad_down)
        bucket.setPower(.8);
    else if (!bucketOverride)
        bucket.setPower(0);
```

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```
    //Press to keep bucket up for endgame
    //NOTE: D-Pad will not work unless gamepad2 B is pressed to end the override
    if(gamepad2.a && bucketOverride == false) {
        bucket.setPower(-.4);
        bucketOverride = true;
    }
    else if (gamepad2.a && bucketOverride == true)
    {
        bucket.setPower(0);
        bucketOverride = false;
    }

    if(gamepad1.right_bumper)
    {
        extension.setPower(.9);
    }
    else if(gamepad1.left_bumper)
    {
        extension.setPower(-.9);
    }
    else extension.setPower(0);
```

```
    telemetry.update();
}
```

Controller Mapping

Gamepad 1

Gamepad 2

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2018 - 2019 Notebook Entries

Week 1 Entries

Our week one focused on brainstorming in strategy and robot design.

TEAM UNCOPYRIGHTABLE 5135	*September 8, 2018*					*2:00 - 6:00 PM*
	Strategize	*Design*	*Build*	*Program*	*Test*	*Compete*
Kickoff Video	Before we separated into our teams, we met with our sister team to watch the kickoff video that was released earlier in the day.					
Mock Game	After watching the kickoff video, we went outside where our mentors set up a mock game using chalk and game elements that we had from prior years. We were split into teams of 4 where 1 acts the robot and we communicate to one another with simple commands over a phone call. After finishing the mock game, the newer members understood how an FTC game is played out.					
5135 Strategic Meeting	The club split into our respective teams and 5135 went into the build room to discuss strategies. Noah, Ronin, and Jay led the discussion as we discussed the pros and cons of each game objective.					

TEAM UNCOPYRIGHTABLE 5135	*September 11, 2018*					*6:00 - 8:00 PM*
	Strategize	*Design*	*Build*	*Program*	*Test*	*Compete*
Strategic Brainstorming	Today we finished comparing potential autonomous strategies and the maximum amount of points that we can earn. We also looked over our driver control and end game strategies. We came up with our initial strategy to land, sample and claim then score into the lander.					
Drivetrain Brainstorming	We brainstormed five potential drivetrains that we would use for this competition. We eliminated X-Omni as it wouldn't enable us to go into the crater. We eliminated mecanum as we felt that it was too heavy for this competition and we were left with 4-wheel, 6-wheel and tank tread drivetrains. We eventually went with 6 wheel as it would eliminate the possibility of beaching the robot on the crater wall.					

TEAM UNCOPYRIGHTABLE 5135	*September 13, 2018* PM					*6:00 - 8:00*
	Strategize	*Design*	*Build*	*Program*	*Test*	*Compete*
Lifting Mechanism Lesson	In the beginning of today's meeting, our mentors separated 5135 and 11285's build and design teams so we can discuss potential lifting mechanisms. We discussed the types of mechanisms that can be used, such as cascading linear slides, rack-and-pinion, and scissor lifts. After much discussion, we ruled out the scissor lift because it had multiple weak points when it extends and retracts.					
Programming Lesson	The programmers of team 5135 and 11285 got a programming lesson where we learned about the different primitive data types in Java. Then we had a mini lesson in binary where we learned what it was and how to use it to represent numbers in the base-2 system. After that, we built a class and learned how to declare and initialize variables. Finally, we did a few basic math operations with integers and learned how to print it out to the screen.					

Matrices

Autonomous Pros & Cons

Landing	Claiming	Parking	Sampling
Pros: Most points Same mech. as latching	Pros: Possibly same mech. as scoring Decreases opponent's chance of scoring	Pros: Simple Associated with Sampling	Pros: Good amount of points Fairly easy Might be easier to claim
Cons: Less driving time in Auto	Cons: Waste if partner does not claim Higher chance of de-sampling	Cons: Least points Higher chance of de-sampling	Cons: Coding difficulty Might not be able to claim

Strategy Brainstorming

S = Sampling, L = Landing, C = Claiming, P = Parking

Auto	Tele-Op	Endgame
S+C(40) L+S+P(65) S+C+P(50) L+C+P(55) L+S+C(70) Gold in depot after sampling(30) S+P(35) S+scoring gold in depot +C(45) C+P(25)	Gold in Cargo Hold(15) Silver in Cargo Hold(15) Stealing from Depot and Scoring in Cargo Hold(20)	Parking in Crater(25) Latch(50) Parking + stealing(25)
FINAL STRATEGY		
Depot Side: L+S+C Crater Side: L+S+P	Steal from Depot and Score in Cargo Hold	Continue Scoring and Latch

Points of Each Objective

Objective	Auto Pts	Tele-op Pts	End Game Pts
Robot			
Landing	30	-	-
Claiming	15	-	-
Parking	10	-	-
Sampling	25	-	-
Latching	-	-	50
Robot In Crater	-	-	15
Robot Entirely in Crater	-	-	25
Mineral			
Depot	2	2	2
Cargo Hold	5	5	5
Gold in Silver	0	0	0
Silver in Gold	0	0	0

Drivetrain Design Matrix

	Traction	Maneuverability	Weight	Size	Total
X-omni	3	8	3	2	16
4-wheel	5	5	5	5	20
6-wheel	6	4	4	4	18
Mecanum	4	7	2	4	17
Tank Treads	8	3	3	3	17

Photos

5135 and 11285 Kickoff Meeting

5135 Strategic Meeting

Lifting Mechanism Lesson

Field Assembly

Week 2 Entries

This week we finalized our subsystems list on our competition robot.

TEAM UNCOPYRIGHTABLE 5135	*September 18, 2018*					*6:00 - 8:00 PM*
	Strategize	*Design*	*Build*	*Program*	*Test*	*Compete*
Lifting Mechanism Brainstorming	Today we finished our design matrix on lifting mechanisms. We chose to remove chain as we felt that it height limited us last year during Relic Recovery and we want to maximize height. We also removed the lead screw for similar reasons as it also height-limited us and we have lack of experience with it. We chose to go with linear slides since it had a lower profile compared to the rack and pinion system.					

TEAM UNCOPYRIGHTABLE 5135	*September 20, 2018*					*6:00 - 8:00 PM*
	Strategize	*Design*	***Build***	***Program***	*Test*	*Compete*
Drivetrain Prototype	When the meeting started, we figured out the dimensions of our prototype chassis. Once we figured out our dimensions and made a diagram, we cut a piece of wood to act as our chassis. Once the wood was cut we used stencils of the REV expansion hub and the motor hubs to create the holes we would use to attach the electronics and motors.					
Programming Lesson	Today we learned how to make a class in Java and the proper syntax to do so. After that, we learned how to write a for-loop and how to write if-statements. Then, we wrote sample programs in our notebooks using said statements.					

Matrices

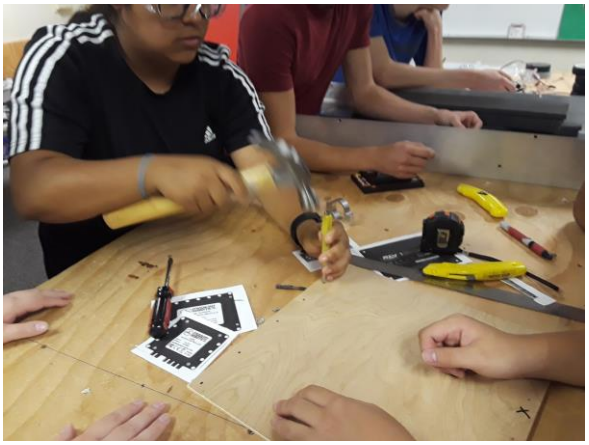
Lifting Mechanism Design Matrix

	Height	Weight	Size
Cascading Linear Slide	8	3	6
Cont. Linear Slide	8	3	6
~~**Chain Lift**~~	~~4~~	~~6~~	-
~~**Lead Screw**~~	~~4~~	~~6~~	-
~~**Rack-Pinion**~~	~~6~~	~~7~~	-

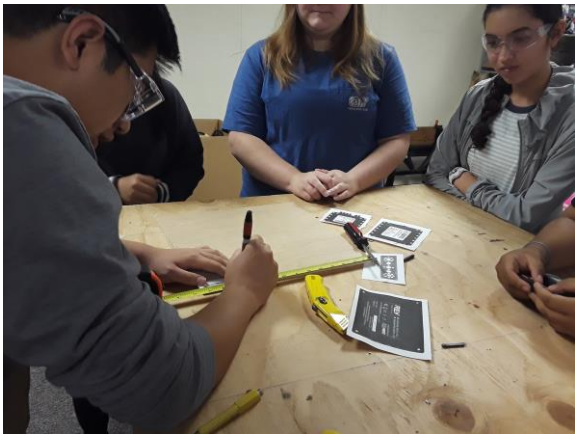
Pros & Cons of Rack and Pinion and Linear Slides

Rack and Pinion	Linear Slides
Pros: Lighter	Pros: Easier to get more height
Cons: Backdrives easier More motors	Cons: Dependent on strength of string

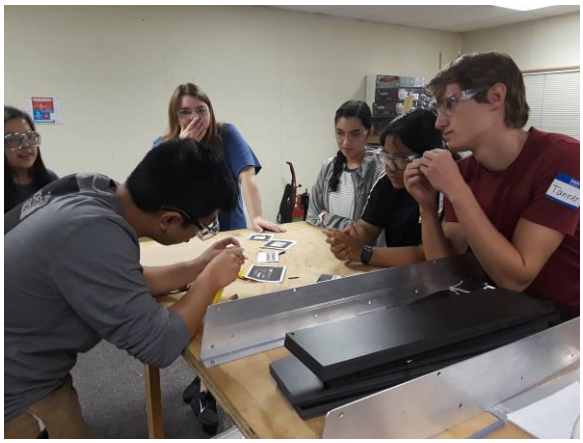
Photos



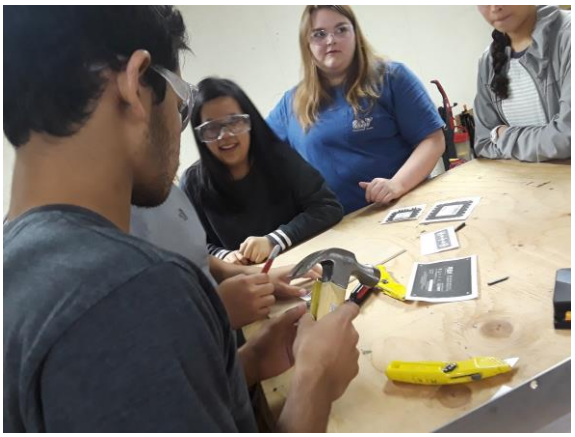
New members punching holes



Noah measuring hole placement



Noah showing members different screw types



Demonstration of puncturing holes

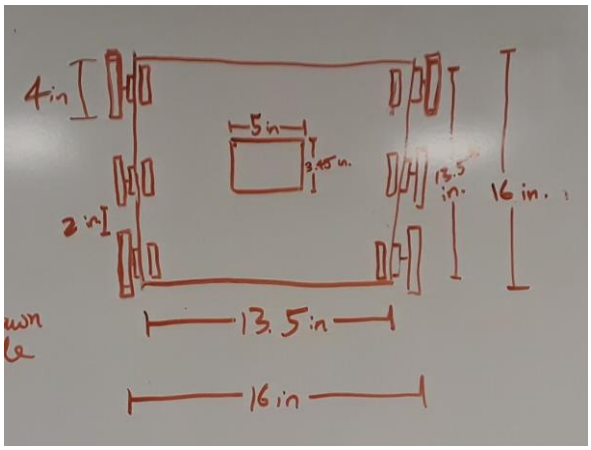
Week 3 Entries

This week we finished brainstorming and prototyping our chassis.

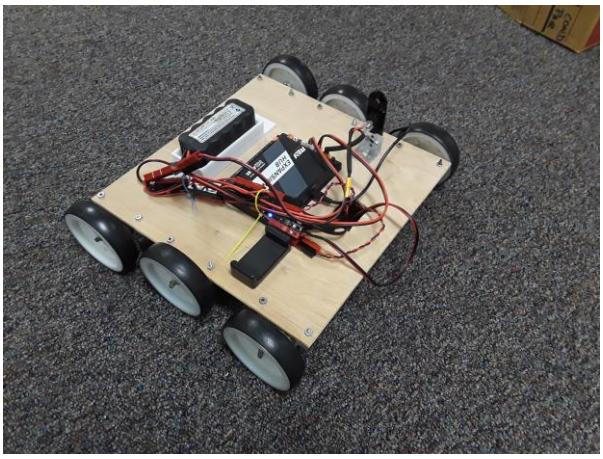
TEAM UNCOPYRIGHTABLE 5135	*September 25, 2018*					*6:00 - 8:00 PM*
	Strategize	*Design*	***Build***	***Program***	*Test*	*Compete*
Drivetrain Prototype	We finalized building the prototype chassis and electronics. Noah did a short lesson on creating a simple teleop code so we can test if the robot can go over the crater. During that time Ronin, Jay, and Alex did a short lesson on building a simple arm. Once we got our programming robot drivable, we took the chassis to our practice field and tested the 6 wheel drive system. To our relief, it worked as expected.					
Programming Lesson	Today, we learned about making methods and objects in Java. We used an example of a car object with attributes of make, model, and year. We then created multiple car objects and printed their attributes to the screen.					

TEAM UNCOPYRIGHTABLE 5135	*September 27, 2018*					*6:00 - 8:00 PM*
	Strategize	***Design***	*Build*	*Program*	***Test***	*Compete*
Drivetrain Testing	Today, Noah demonstrated the six wheel drive train that our team built as part of an activity. As a team we decided that we were pleased with the result of the drivetrain and we are going to continue with our plan to implement it on our robot.					
Collection Mechanism	As a team we decided to start making decisions regarding the collection mechanism. Along with Jay and Ronin, Noah led the discussion on which mechanism we should use. We made a design matrix, however we were not able to come to a conclusion just yet.					

Photos



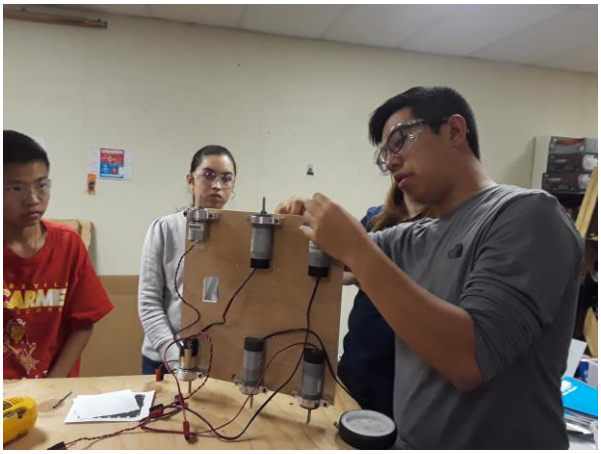
Drivetrain Prototype Dimensions



Programming Robot

Collection Ideas
Extending arm
Turbine
Claw
Scoop
Extending Bucket
Rubber Band Intake
Excavating Cup
Wheel Intake

Collection Mechanism Brainstorming



Build Lesson on Motor Mounts

Week 4 Entries

This week we continued brainstorming our subsystems and had a short lesson about 3D printing. At the end of the week, we also showcased our robotics program at Maker Faire in Balboa Park.

TEAM UNCOPYRIGHTABLE 5135	*October 02, 2018*					*6:00 - 8:00 PM*
	Strategize	***Design***	*Build*	*Program*	*Test*	*Compete*
Collection Mechanism	Today we brainstormed how to collect the minerals on the field. Our design matrix had multiple subsystems that have been proven to work in past games. We considered a spinning collector that our team briefly tested during Velocity Vortex. Compliant wheels were also considered which were utilized by other teams during Relic Recovery. We also considered a intake that would conform to the mineral's shape using rubber bands. We had a three way tie between the flap, the windmill and the rubber band intake. Ultimately we chose to go with the rubber band intake due to the simplicity of the design.					
Scoring Mechanism	We created another design matrix to figure out what would be the best scoring mechanism for the lander. By scoring mechanism we are referring to how we would get the minerals from ground level and up to the height of the lander. We considered launching but after reading the rules, we felt that its cons outweigh the pros because we can only launch from right under the lander. We ultimately chose to use the same lift that we would use for latching in order to streamline our build process and keep the weight of the robot under the maximum limit.					
Latching Mechanism	After going over collection and scoring, we went over one of the most important subsystems for this year's game - the latch. We went through various designs such as a rack and pinion system and a basic hook. For ease of building we went with a basic hook.					

TEAM UNCOPYRIGHTABLE 5135	*October 4, 2018*				*6:00 - 8:00 PM*
	Strategize	***Design***	*Build*	*Program*	*Test*	*Compete*
3D Printing Presentation	Our mentor Joey showed us our new Monoprice Select Mini 3D printer and gave a presentation on safety and the various types of material the printer can use. We use these printers for smaller pieces of the robot and utilize our sponsor, Form Factories, for larger pieces of the robot.					
3D Modelling Demonstration	Noah demonstrated to our team how to use Autodesk Inventor and created a keychain with his name as an example of how to use the various tools of the program.					
Cura Demonstration	Noah demonstrated how to transfer files from Autodesk Inventor to Cura for printing. Cura is a 3D printing “slicer” software that converts 3D models into machine code that the 3D printer can read. He showed us how to properly set up the print speed and how to change various settings about the print such as the density.					
Preliminary Design Review(PDR)	Today we began work on the preliminary design review. Our team split into groups and prepared a short speech on why we went with certain mechanism over others. Nathan and Carlos worked on the collection. Sam, Shol, and Sherry worked on the drivetrain. Gloria, Hartej, and Pranav worked on the goals for the season. Noah and Enrique helped explain the strategy. Alex, Ronin and explained the lift. Anu, Kobe, and Olivia explained the scoring mechanism					

TEAM UNCOPYRIGHTABLE 5135	*October 6, 2018*	*MakerFaire Day 1 & 2*
	Outreach	
Maker Faire San Diego	For the third year in a row, we attended Maker Faire San Diego with our sister team as well as the team we helped to create at the local middle school, Black Mountain Middle School. We used this event as an opportunity for outreach as we brought a mini playing field and small "outreach robots" for the public to drive. Members of our team had productive conversations about the current robot game with other teams and were able to educate members of the public about robotics and 3D printers. Generous attendees also donated to our club in exchange for small "SD" letter keychains.	

Matrices

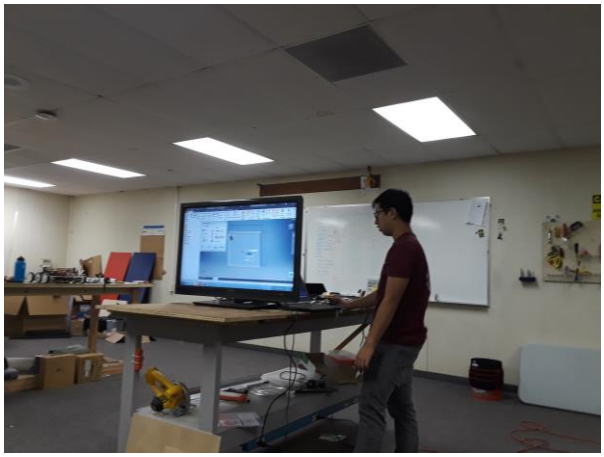
Collection Mechanism Design Matrix

Mechanisms	Speed	Reliability	Weight
Flap	5	7	7
Turbine	7	6	6
Claw	4	4	4
Wheel	8	5	3
Rubber Band Intake	6	7	6

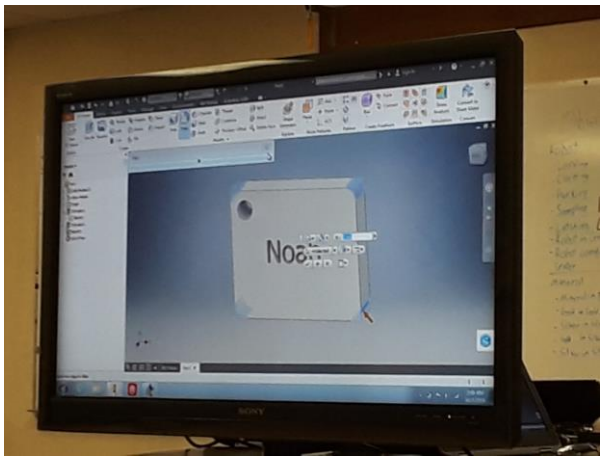
Scoring Mechanism Design Matrix

Mechanisms	Weight	Speed	Reliability
Same Lift	5	4	6
Second Lift	3	5	7
Launching (stored energy)	7	7	4
Launching (active)	6	7	3

Photos



Noah explaining Autodesk Inventor.



The keychain Noah modeled.

Members of 5135 setting up the booth for our outreach robots at Maker Faire

Our outreach setup as kids play with the robots.

Week 5 Entries

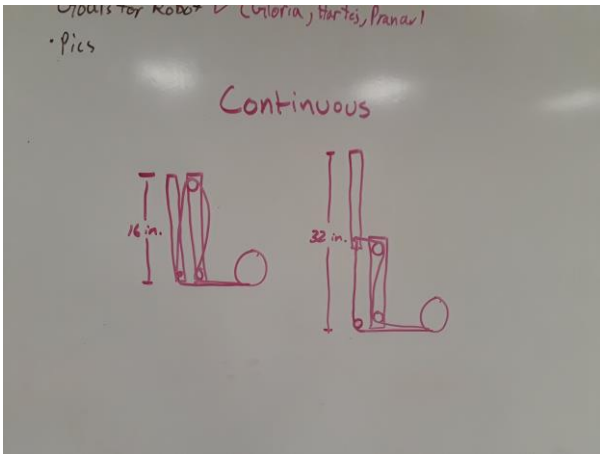
This week we presented a preliminary design review to our mentors and sister team 11285 on how we plan to approach the Rover Ruckus challenge.

TEAM UNCOPYRIGHTABLE 5135	*October 9, 2018*					*6:00 - 8:00 PM*
	Strategize	***Design***	*Build*	*Program*	*Test*	*Compete*
Preliminary Design Review (PDR)	Our team presented a preliminary design review about our robot. This presentation includes detailed dimensions of all of the subsystems we plan on adding to the robot. It also has design matrixes of each different choice for the subsystems so we could effectively convey why we chose what we did. Our mentors were very helpful in critiquing our initial design and helped us to think critically about our plans.					

TEAM UNCOPYRIGHTABLE 5135	*October 11, 2018*					*6:00 - 8:00 PM*
	Strategize	*Design*	*Build*	*Program*	*Test*	*Compete*
Judging Example Video	In order to show us good presentation techniques, our mentors showed us a video from the 2016 World's Inspire Award Winner, Team 7013 Hot Wired Robotics.					
PDR Overview	Our club analyzed both our own team and our sister team's PDR. We received helpful tips that will improve our judge's interview.					

Photos

Team members work on the preliminary design review



Dimensions of the linear slides

Members watch a judging example video

Week 6 Entries

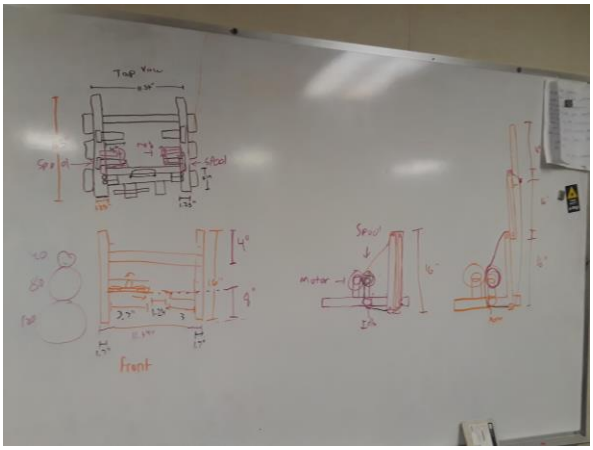
This week we separated into groups and created preliminary dimensional drawings so that our design team can work on the CAD model.

TEAM UNCOPYRIGHTABLE 5135	*October 16, 2018*					*6:00 - 8:00 PM*
	Strategize	***Design***	*Build*	*Program*	*Test*	*Compete*
Discuss Latching Mechanism	According to feedback from our PDR, our mentors wanted us to create a more robust latching system that was more than just a bar. As a team we decided to go with a rack and pinion style latcher.					
PDR Recap	Following our PDR, we analyzed changes to our initial plan that we wanted to make. We decided to change our continuous two stage lift to a single stage lift because we decided that we did not need as much lift as required by a double stage lift.					
Chassis Design	Our team split into two groups and began preliminary dimensioned drawings for the chassis of our robot.					
Lift Design	Our team as a whole discussed the structure of the lifting mechanism that we decided on with the design matrix.					

TEAM UNCOPYRIGHTABLE 5135	*October 18, 2018*					*6:00 - 8:00 PM*
	Strategize	***Design***	*Build*	*Program*	*Test*	*Compete*
Chassis Design	Our team completed preliminary dimensioned drawings that were started at the previous meeting for the chassis.					
Lift Design	We completed the preliminary dimensioned drawings for the lifting system					

Photos

Team splits into smaller groups to discuss ideas for a latching system



Preliminary dimensioned drawings of subsystems

Week 7 Entries

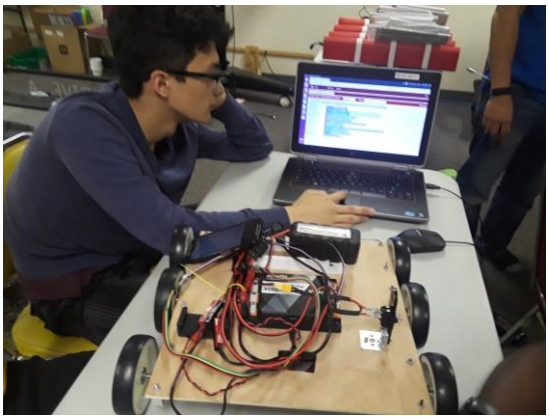
This week our mentors greenlit our designs and started work on our Chassis and Lifter subsystem.

TEAM UNCOPYRIGHTABLE 5135	*October 23, 2018*					*6:00-8:00 PM*
	Strategize	*Design*	***Build***	***Program***	*Test*	*Compete*
CAD Model	After preliminary drawings for the chassis and lift, we decided that we wanted to use a CAD-first approach this season. Due to being a school team and using school facilities as a club, our meeting time is limited to two times a week for two hours a meeting. This reduced meeting time means we have less time compared to other teams. Since we are already starting the build season late compared to previous years, our very dedicated design team decided to take the initiative to work on the CAD model at home on their own time, to have it ready to begin building during the meeting.					
Start of Chassis	Jay and Alex started work on the chassis while Noah and Ronin discussed with our mentors on a wheel base revision. The build team followed the basic CAD design for the chassis.					
Wheel Base Revision	Due to a miscommunication with our mentors earlier in the design process, we thought that we needed gears in addition to the sprockets used in our drive train. We were allowed to proceed with removing the gears and just using sprockets.					

TEAM UNCOPYRIGHTABLE 5135	*October 25, 2018*					*6:00-8:30 PM*
	Strategize	*Design*	***Build***	***Program***	*Test*	*Compete*
Continuation of Chassis	Jay and Alex continued work on the chassis, separating it in two pieces so they could work on it simultaneously. This year, we decided to mount our motors above the rails instead of below in order to power six wheels with only four motors. We did this using chain.					
Latch Revision	Thanks to a video by Team 12618 Algorhythms, our team decided to switch from a rack and pinion style latch to a passive latch that has a limited range of motion, allowing our robot to lock onto the lander without using a servo.					

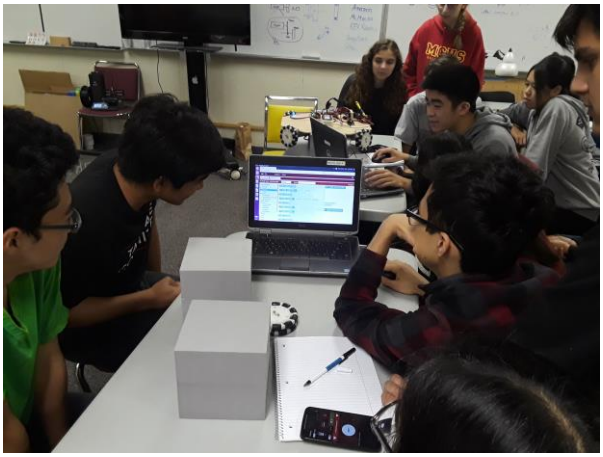
Photos

Build team working on wheels for the chassis



Nathan teaching how to use block programming for autonomous

Build team working on wheels for the chassis



Kobe, Shol, and Michi learning how to use block programming for autonomous

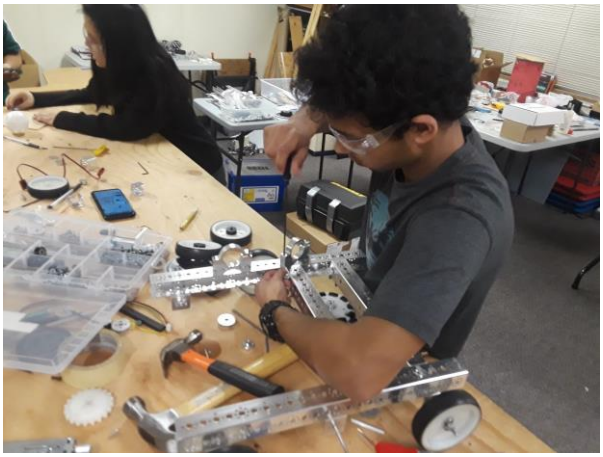
Week 8 Entries

This week we finalized our chassis, tested the UHMWPE Cord, and started work on our three main subsystems.

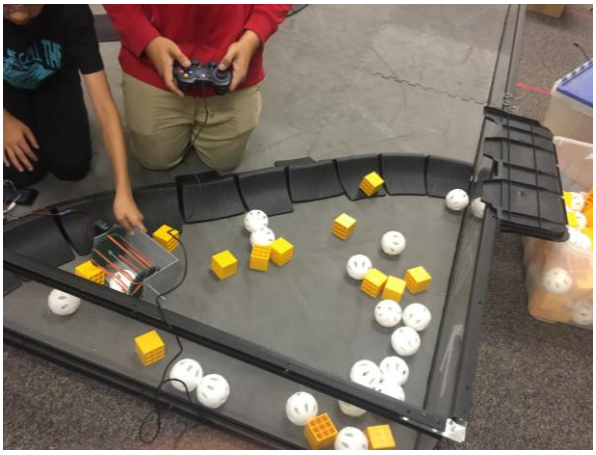
TEAM UNCOPYRIGHTABLE 5135	*October 30, 2018*					*6:00 - 8:30 PM*
	Strategize	*Design*	***Build***	***Program***	*Test*	*Compete*
Chassis	Ronin and Alex started attaching the motor mounts to the chassis that we assembled last week. Other build members worked on the wheels as we decided to switch back to regular wheels rather than stealth wheels.					
UHMPWE Cord Test	Today we performed our first test of the UHMPWE Cord and the winch system that we designed. Using an inner diameter of 1.5 inches, we found that a standard Neverest 60 had enough torque to lift 20 lbs, which was enough for our purposes.					
Collection Subsystem	The collection subsystem was delegated to Carlos and Jay to assemble and test. We chose to use a VEX EDR 393 motor in order to achieve more power/speed than what a Continuous Rotation (CR) servo could output. In order to keep the collector as lightweight as possible, we used VEX gears and sprockets. During testing we found that the collector couldn't capture two minerals simultaneously due to lack of torque. We also found that the minerals have a tendency to launch back out onto the field. To remedy this, we elected to create a shroud for the collector and switch to a 1:1 gear ratio.					
CR Servo Test	In order to test the VEX EDR 393 motor in the collection mechanism, our build team needed a test op-mode. After doing some research we found that the VEX EDR 393 motor, which was connected to the REV Servo Power Module with the VEX Motor Controller 29 would have to programmed as a CR Servo instead of as a DC Motor. In addition we found that the maximum power value that the VEX EDR 393 would take is 0.8 because the motor controller could not take the maximum range of pulses provided by the Rev Hub.					

TEAM UNCOPYRIGHTABLE 5135	*November 1, 2018*					*6:00 - 8:30 PM*
	Strategize	*Design*	***Build***	*Program*	*Test*	*Compete*
Lifter Subsystem	We installed the linear slides that formed the base of our lifting subsystem. We found that the linear slides need more support than just being bolted to the U channel as the entire weight of the robot would be going up and down the linear slides during autonomous and end game.					
Collection Subsystem	After going over our main issues last meeting regarding our collector, Carlos and Jay switched our gear setup to a 1:1 in order to achieve more torque. In order for this to happen we required a new collection bucket that was designed by the design team after our last test of the collector. Once we finished moving over our current setup from the old bucket to the new one, we tested it out on the field and successfully collected two minerals simultaneously.					
Latch Subsystem	Alex worked on cutting metal for the latch prototype. After multiple attempts at drilling the metal, we decided the best way to create the latch is to 3D print the pieces. Due to this, we consulted with our sponsor, FormFactories, on which material is best suited for lifting a 20-30 pound robot.					

Photos

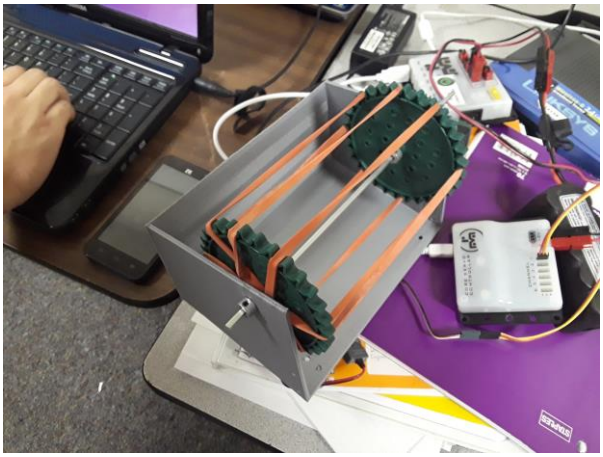


Build team working on wheels for the chassis

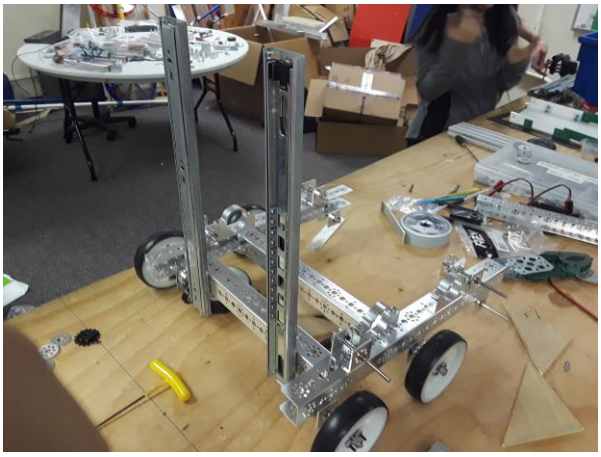


Noah and Jay testing the collection mechanism

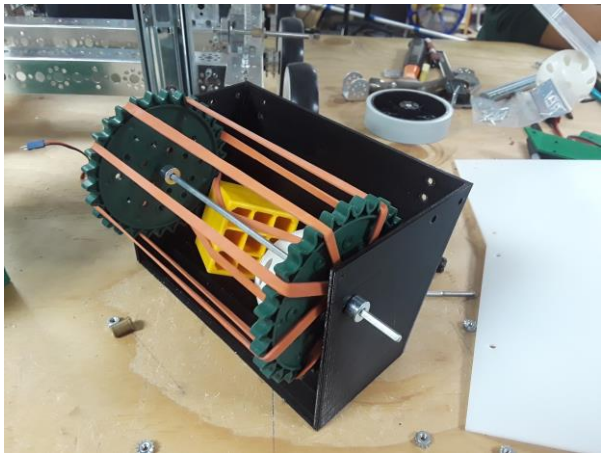
Alex drilling holes for chassis



Testing the rubber band intake



Attachment of linear slides onto the base of the drivetrain



Rubber band intake collection mechanism

Noah showing Sam how to use the belt sander

Ronin drilling holes for the lift mechanism

Week 9 Entries

This week we added chain to our drivetrain and started work on our rubber band intake.

TEAM UNCOPYRIGHTABLE 5135	*November 6, 2018*					*6:00 - 8:30 PM*
	Strategize	*Design*	***Build***	*Program*	*Test*	*Compete*
Drive Train	The build team attached motors, decided on a chain path, and finished attaching wheels to the drivetrain.					
Collection	We assembled the collection mechanism after our team captain visited FormFactories to get the chute for the front bucket. We attached the pieces together and put the entire collection mechanism on the robot.					
Latch Subsystem	After deciding on a geometry for the latch, Noah decided that he wanted to test two different latches, one made of metal and one 3D printed. The 3D printed one would be weaker but able to have more accurate and custom geometry, and easier to make. Worried about the strength, Noah also made templates for a metal latch to alleviate the issues that we had with fabricating the latches in the last meeting					

TEAM UNCOPYRIGHTABLE 5135

November 8, 2018

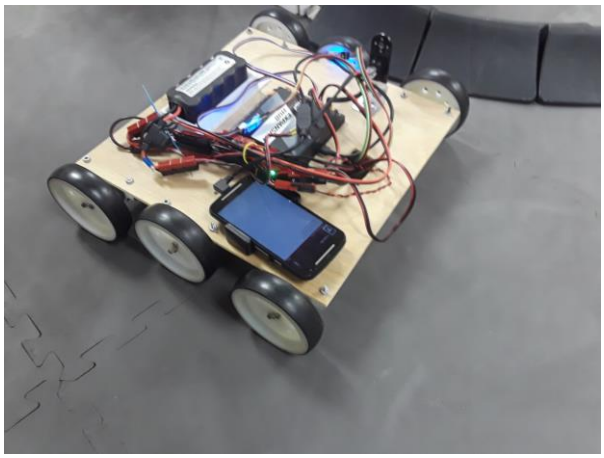
6:00 - 8:30 PM

Strategize	*Design*	***Build***	***Program***	*Test*	*Compete*

Drive Train	We measured and cut the chain needed for the drivetrain, attaching the chain to the motors.
Collection Subsystem	Jay and Carlos finished changing the gear ratio of our collector and reattaching the collection onto the chassis. This improved the torque, and reduced jams but sacrificed speed
Latch Subsystem	Gloria began fabrication of the metal latches based off of templates created by our design team. She first cut the metal bars down to size using our horizontal bandsaw and then rounded off the corners using the hacksaw and belt sander.
Autonomous	The programmers tested autonomous routes they coded using block programming. Nathan also researched how to implement TensorFlow onto our robot for mineral detection.

Photos

Noah teaching new members how to assemble chain



Programmers test Autonomous routes using the programming robot

Week 10 Entries

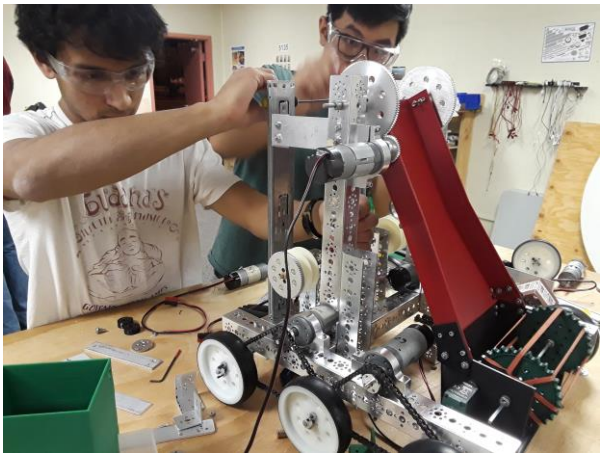
This week we rigged our pulley system and finalized our lift.

TEAM UNCOPYRIGHTABLE 5135	*November 13, 2018*					*6:00 - 8:30 PM*
	Strategize	*Design*	***Build***	*Program*	*Test*	*Compete*
Lift	Tanner and Ronin worked to brace the drawer slides, using Tetrix for support. After this was complete, they added pulleys to the side of the drawers slides for to prepare the robot for rigging.					

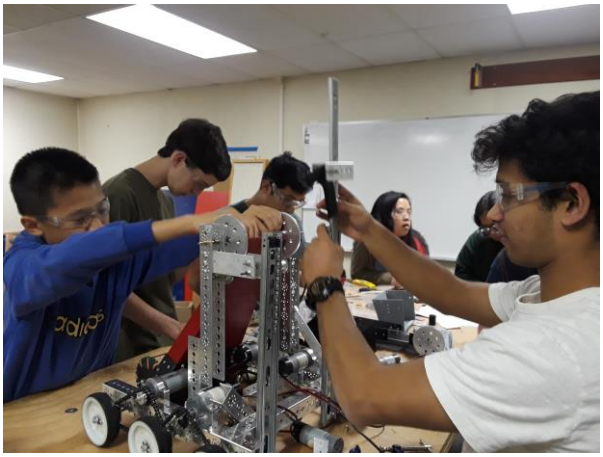
Latch Subsystem	After seeing the PETG 3D printed latches and testing the strength of the latches, the team decided to go with the 3D printed latches instead of the metal ones that Gloria began fabricating. We felt that the latches were strong enough and their custom geometry made it easier to integrate in our robot. After reinforcing the linear slides, Carlos and Ronin attached the new latching mechanism to the robot.

TEAM UNCOPYRIGHTABLE 5135	*November 15, 2018*					*6:00 - 8:30 PM*
	Strategize	*Design*	***Build***	*Program*	***Test***	*Compete*
Pulley System	After attaching extra guiding pulleys for the lift, Ronin and Noah rigged the pulley system with UHMWPE cord to lift and lower the robot. They had issues with keeping the string tension consistent throughout the entire lift but fixed this through retensioning the string.					
Test	After rigging the pulley system we tested the latching mechanism on the lander. We confirmed that the latches were able to handle the entire weight of the robot.					

Photos

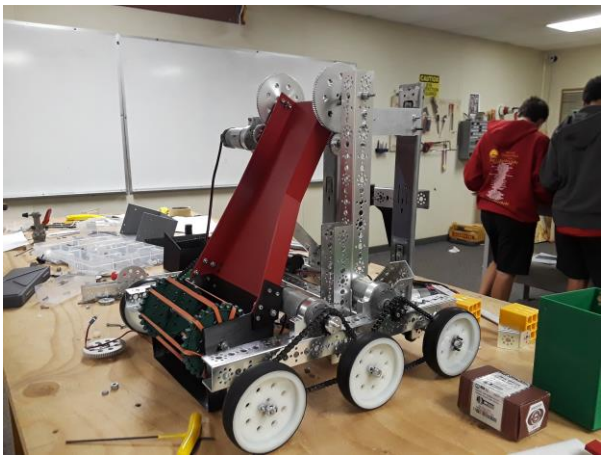


Noah and Ronin beginning on the pulley system



Carlos and Ronin attaching the latching system to the linear slides

Reattaching linear slides



Progress of *Spirit* as of Week 10

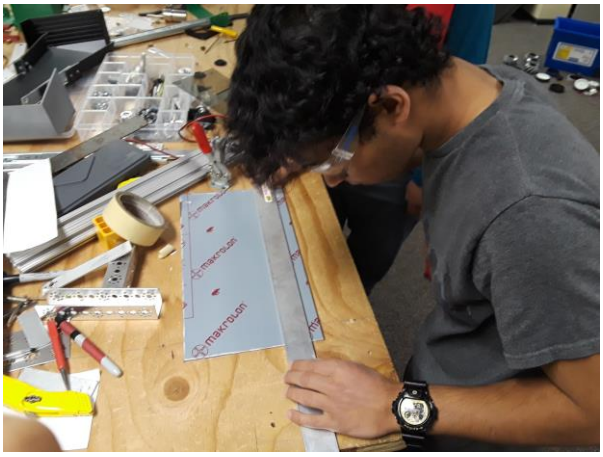
Week 11 Entries

This week we refined issues we found last week with the pulley system and buckets.

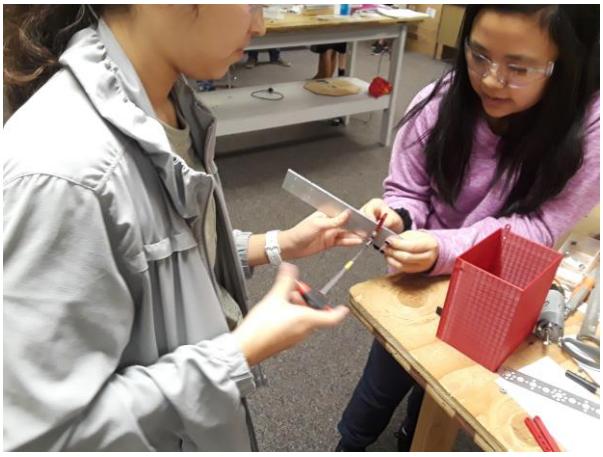
TEAM UNCOPYRIGHTABLE 5135	*November 19, 2018*					*6:00 - 8:30 PM*
	Strategize	*Design*	***Build***	*Program*	*Test*	*Compete*
Lifter	Noah and Ronin tested different knots for the pulley for the lifting mechanism for strength and durability. They also took apart the linear slides to add more holes to further support the subsystem.					
Rear Bucket	Sam and Sherry worked on drilling holes that are needed to support the rear bucket and its servo. They started screwing in the arms for the bucket.					

TEAM UNCOPYRIGHTABLE 5135	*November 20, 2018*					*6:00 - 8:30 PM*
	Strategize	*Design*	***Build***	*Program*	*Test*	*Compete*
Lifter	Ater making the holes for support brackets last meeting, Ronin and Tanner reattached the linear slides onto the robot. We also received the new 3D printed latches for hanging so we attached them on the linear slides.					
Rear Bucket	Sam and Sherry worked on attaching the rear bucket to the linear slides. The servo needed to move the bucket was also attached. We found that the bucket couldn't flip up all the way so we added a linkage that would allow the rear bucket to flip up at a more aggressive angle.					
Number Plates	Ronin measured the robot to figure out the sizing for the number plates. He drew the plates onto the lexan sheet and marked where holes needed to be drilled.					

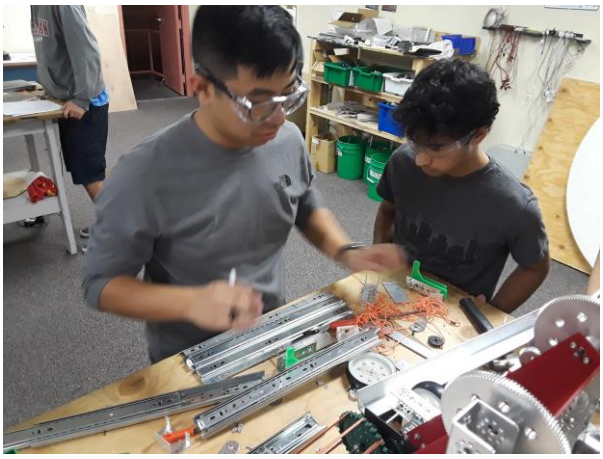
Photos



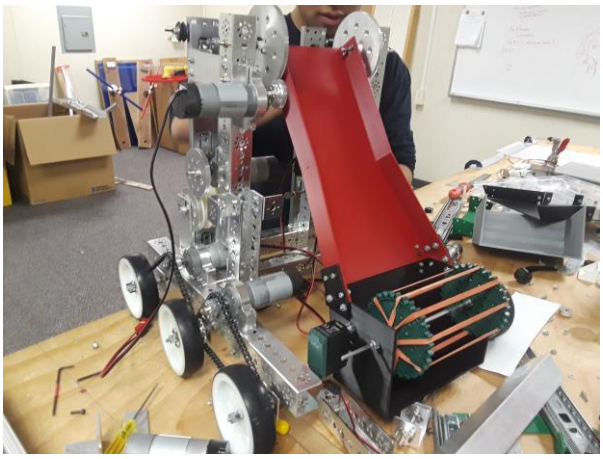
Ronin marking lexan for the robot number plates



Sam and Sherry working on attaching the rear bucket



Noah and Ronin marking holes for linear slides



***Spirit* as of Week 11**

Week 12 Entries

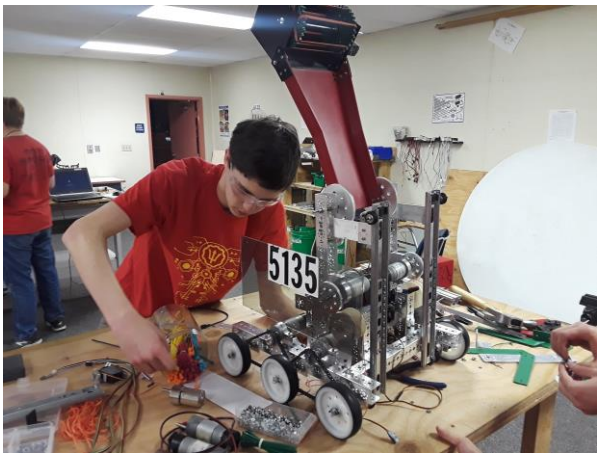
This week we finalized *Spirit* (Version 1) and prepared for STEAM Maker Festival.

TEAM UNCOPYRIGHTABLE 5135	*November 27, 2018*					*6:00 - 8:30 PM*
	Strategize	*Design*	***Build***	*Program*	*Test*	*Compete*
Team Picture	Before the meeting, we took a team picture with our sister Team 11285 Patent Pending for usage in the school yearbook.					
Wiring	Alex worked on mounting electronics to its plate. After this he used zip ties to tie the wires into a smaller bundle, which helped making the robot more organized.					
Rear Bucket	After putting the rear bucket on the robot, we realized that the top of the bucket was too high for the front bucket to reach. We used a hacksaw to saw off a diagonal piece and inserted cardboard to make sure the minerals would fit.					

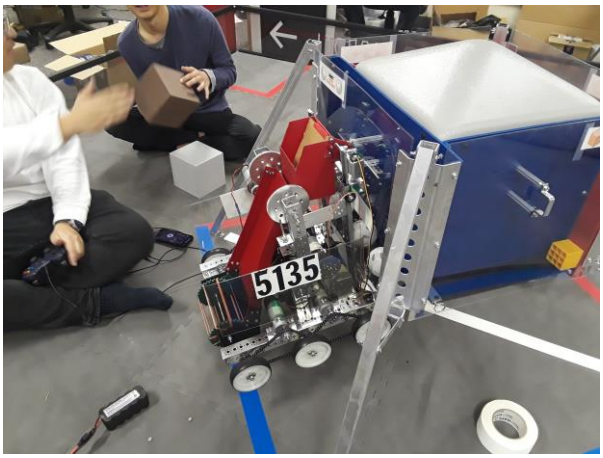
TEAM UNCOPYRIGHTABLE 5135	*December 1, 2018*					*6:00 - 8:30 PM*
	Strategize	*Design*	***Build***	*Program*	***Test***	*Compete*

Number Plates	Ronin worked on cutting out the number plates that he measured the previous week. Jay added the number stickers to the plates. We then drilled holes onto the plate so we can attach it to our robot.
Testing	Noah worked on testing the latching mechanism of the robot. Along with the programming team we were able to perform the first driver controlled hang of season. The rest of the meeting was spent on cable management.

Photos



Alex works on tying together the electrical wiring



Testing the latching mechanism

Club Picture along with 11285

Week 13 Entries

This week we refined *Spirit* for our first competition and laid out the groundwork for Robot V2.

TEAM UNCOPYRIGHTABLE 5135	*December 4, 2018*				*6:00-8:30 PM*
	Strategize	*Design*	***Build***	***Program***	*Test*	*Compete*

Refinement Plans	After the scrimmage, we laid out plans on how to refine the robot for our competition in a week. On the whiteboard, we created a list then chose changes that we could realistically do within two meetings. We decided that any drastic changes on the robot will be implemented on robot V2.
Collector	During the scrimmage, we realized the speed of our collector was slower than what we wanted. Originally we contemplated using the high speed gear system but ultimately chose to use two different gear ratios that were a middle ground between our original gear ratio from week 8 and the current gear ratio on the robot.

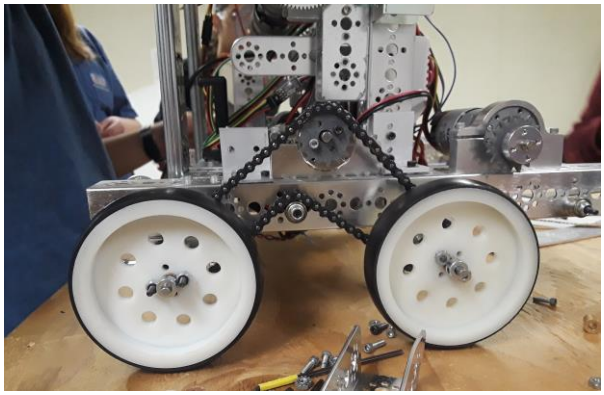
TEAM UNCOPYRIGHTABLE 5135	*December 6, 2018*				*6:00-8:30 PM*	
	Strategize	*Design*	***Build***	***Program***	*Test*	*Compete*
Lifter	We switched out gripnuts for nylock nuts so that the nuts would not cut through the UHMWPE cor. We found this very necessary as we one of our cords snapped during a scrimmage match.					
Collector	Once we got our new 3D printed collector, Jay transferred the Vex EDR 393 motor onto its new mounting points and set up the collector with the new gear ratio. When we tested the new collector on the field, it was the right amount of speed and torque.					
Drivetrain	We added idlers to the chain in order to enable us to go over the crater wall without rubbing the chain. The idlers lifted the bottom of the chain up, allowing the robot to be driven over the crater.					

TEAM UNCOPYRIGHTABLE 5135	*December 7, 2018*					*6:00-8:30 PM*
	Strategize	*Design*	***Build***	***Program***	***Test***	*Compete*
Lifter	We made final adjustments to the lifting mechanism and made sure everything was running as expected.					
Drivetrain	Yesterday we realized the chain had a tendency of falling off the idlers. To remedy this, we inserted 3D printed washers that would hold the chain in place once it is on the idler.					
Autonomous	Our programming team tested the autonomous on the programming robot. As we were short on time, the autonomous was set to sample the middle mineral which gives us a ⅓ chance of getting the sample point.					
Testing	Unfortunately we had little time to test today due to our phones disconnecting from each other. Our mentors taught us how to properly configure the phones and once we started testing we were met with a few problems on the robot. We realized that the number plates were blocking us from latching onto the lander correctly and the autonomous had issues when transferring from the programming robot to our competition robot. We decided we will fix the number plates at the day of the competition using tetrix pieces that will push the plates further back on the robot.					

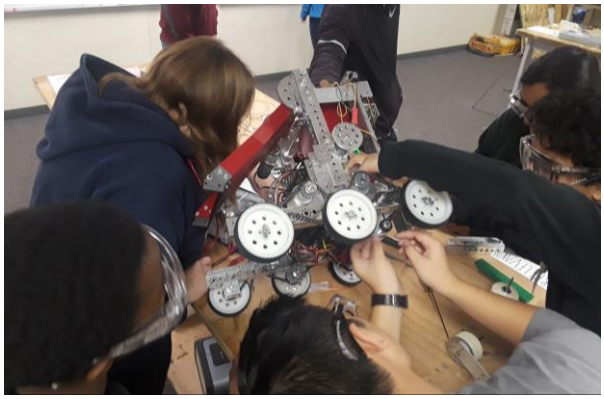
TEAM UNCOPYRIGHTABLE 5135	*December 9, 2018*				*7:00 AM-1:30 PM*
	Strategize	*Design*	*Build*	*Program*	*Test*	***Compete***
League Meet 1 San Diego Jewish Academy	*Overall Placing: 3rd* Noah: The day started out rough as we rushed to make changes on the robot to ensure it wouldn't completely destroy itself in the first match. The night before, we broke multiple things during testing, including messing up the chain tension, lift stringing, wheels, and number plate. Despite this, we made it to compete on time and our first two matches were very rough. We had little time for driver training and as a result could not hang during End Game. After our second match I looked at the results and saw that we were in dead last place out of 12 teams. Ultimately Jay and I resolved a way to communicate properly while driving which was the key to success in our coming matches. We also decided to make some changes to our latch to make it easier to hang in the end game. The rest of the day went very smoothly as we won our next four matches and placed 3rd.					
Reflection	All in all, the league meet went very well and we were pleased with our robot. Our initial plan to drive over the crater did not work because we were too back-heavy, but we were able to score about 5 minerals in the lander consistently, as well as					

	latch and land, which was enough for us place 3rd. We know that as it is right now, our score cap isn't very high and we plan to make some design and strategy changes to improve our scores. In the coming weeks, we plan to make our robot more structurally sound as well as build a mechanism to extend into the crater.

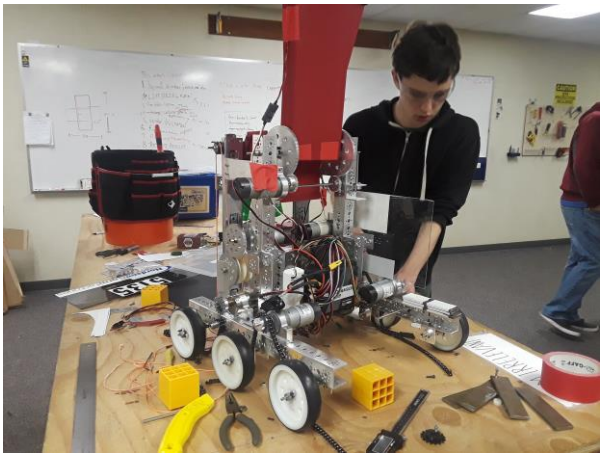
Photos



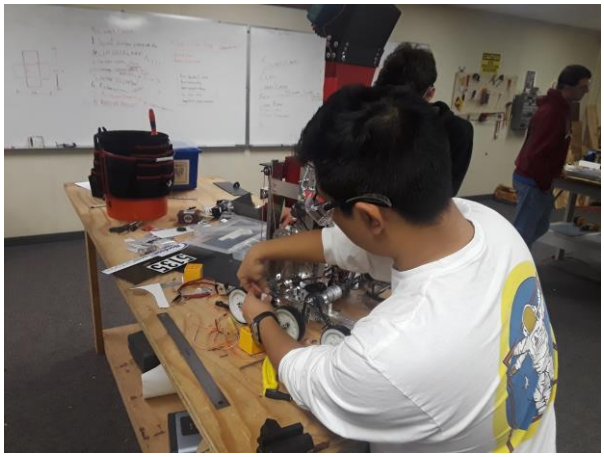
New chain with the addition of idlers



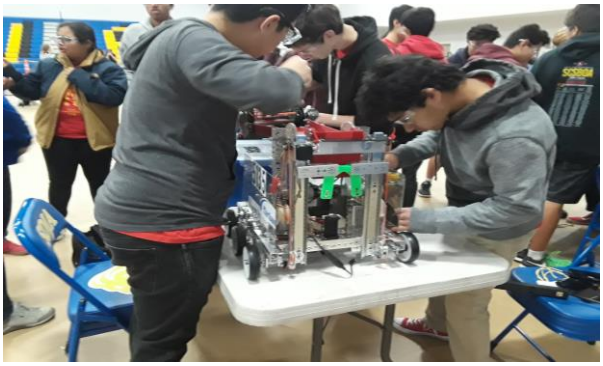
Team working together to adjust the base of the robot



Alex finishing the chain for our drivetrain



Noah fixing the chain tension idlers



Team captains Noah and Ronin making repairs on *Spirit* before our next match.

Noah and Jay during endgame as they position the passive latch for hanging.

Week 14 Entries

This week we reflected on our first league meet and started designing the changes we will make for *Opportunity* (Version 2).

TEAM UNCOPYRIGHTABLE 5135	*December 11, 2018*				*6:00-8:30 PM*
Strategize	***Design***	*Build*	*Program*	*Test*	*Compete*

Critical Design Review	Because our first competition was last weekend, our mentors asked us to perform a critical design review. We compared our plans from our preliminary design review to our current progress. We took the lessons we learned throughout our 5 weeks of building, scrimmage and our first events and laid out redesigns for *Opportunity*, our second version of the Rover Ruckus robot.
Robot Redesign	Although our robot was able to score minerals inside of the lander, the primary issue with our robot was the collection. We planned to drive over the crater wall to collect minerals but in testing our robot's center of gravity was too high to drive over the wall, as we would just tip. We decided to redesign the robot to collect from behind the crater wall.

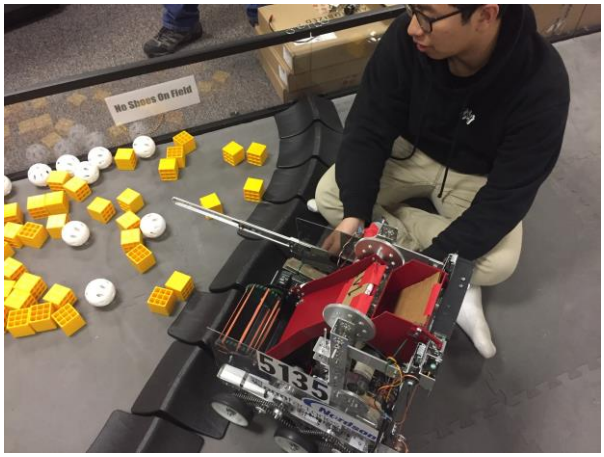
TEAM UNCOPYRIGHTABLE 5135

December 13, 2018 *6:00-8:30 PM*

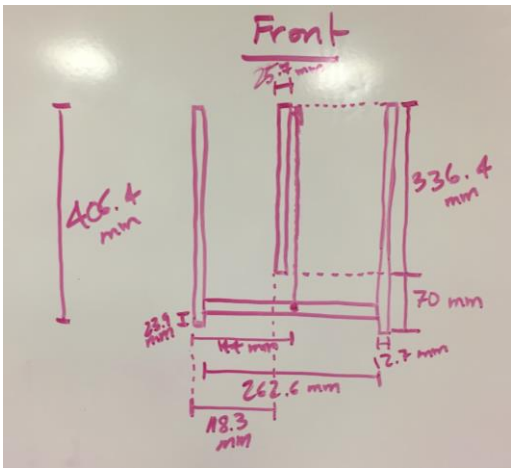
Strategize	***Design***	*Build*	*Program*	*Test*	*Compete*

Chassis Redesign	Since we no longer need to drive over the crater wall, the complicated 6-wheel drive train is unnecessary. We decided to switch to a 4-wheel drivetrain with two Andymark Stealth Wheels and two omni wheels.
Collection Redesign	Because we decided to not drive into the crater, we needed a way to collect minerals inside the crater. We decided to add a linear slide to the middle of the robot with the front bucket and the rubber band intake connected to it. This allows us to be able to extend the collection mechanism into the crater.
Lifter Redesign	After doing calculations, we found out that we only need one motor for the lift instead of two. We also wanted to decrease the weight of the robot and minimize the amount of UHMWPE cord we were going through.
Scoring Redesign	After trying to design a linkage mechanism to dump the rear bucket, we were dissatisfied with the range of motion allowed. To remedy this we decided to use either gears or sprockets to rotate the bucket

Photos

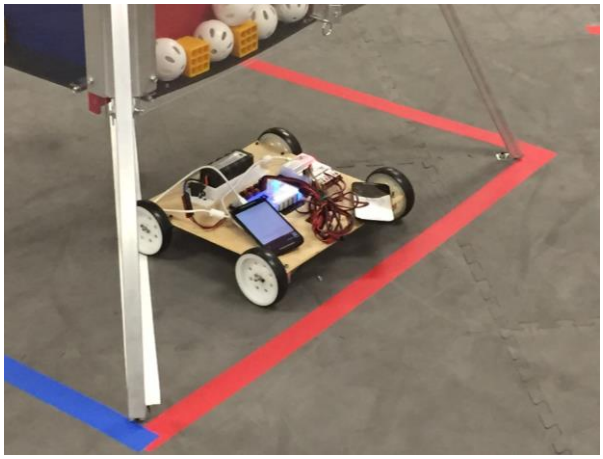


Team Captain Noah sizing up the linear slide we'll be using for the extending collector



Preliminary drawing of our redesigned linear slide system that will utilize one motor instead of two.

Enrique reviewing the autonomous code for our programming robot



Our programming robot getting ready to test one of our autonomous routes

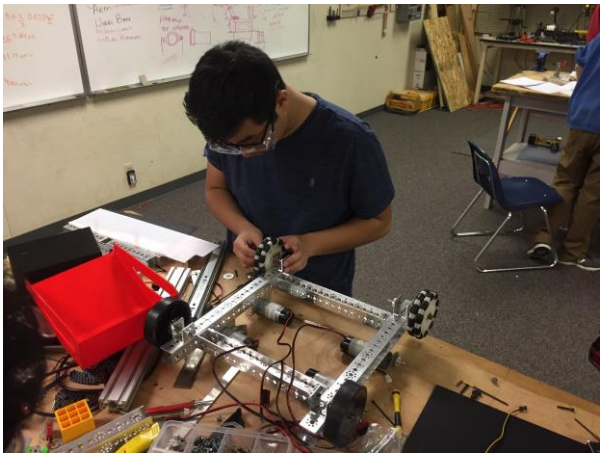
Week 15 Entries

This week our mentors greenlit our designs for robot v2 and started work on the subsystems. Unofficially this is our Robot in Two Weeks Challenge.

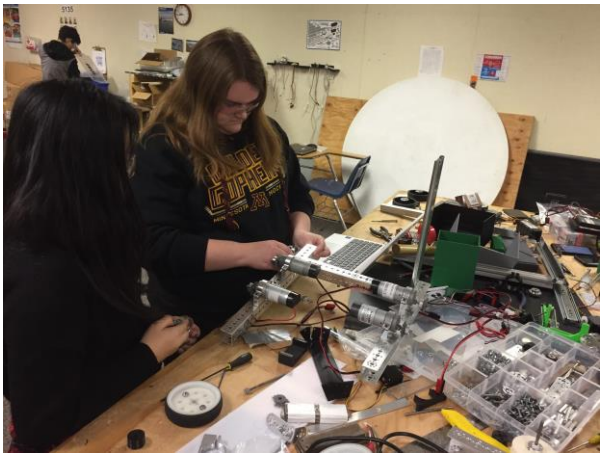
TEAM UNCOPYRIGHTABLE 5135	*December 18, 2018*					*6:00-8:30 PM*
	Strategize	*Design*	***Build***	*Program*	*Test*	*Compete*
Dismantling Spirit	Ronin, Jay, Gloria, and Sam worked on dismantling *Spirit* so we can utilize its pieces for *Opportunity*. We attempted to keep all our subsystems intact but found that it was not feasible as our linear slides were unusable and the front bucket and rear bucket had damage from rough use.					
Extender Subsystem	Noah and Olivia worked on the extending subsystem. They assembled the linear slide system we would be using and tested the rack and pinion using a spare motor. We plan to 3D print the motor mount for the extender and build it separate from the robot next meeting.					
Chassis	Alex and Sherry worked on attaching the tetrix chassis pieces together. Because we had the CAD model our designers made us, we quickly attached the motor mounts and the wheel attachment points.					

TEAM UNCOPYRIGHTABLE 5135	*December 20, 2018*					*6:00-8:30 PM*
	Strategize	*Design*	***Build***	*Program*	*Test*	*Compete*
Chassis	Jay, Alex, and Olivia continued work on the chassis while Sherry and Sam worked on the chain for the new drivetrain. We replaced the lone Tetrix 40:1 motor and attached 4 Neverest 40:1 motors to the chassis, We utilized the same 3D printed sprockets that FormFactories printed out for us, as they worked incredibly well on *Spirit*.					
Extender Subsystem	Noah installed the motor mount we 3D printed onto the chassis. We also added a pulley system that utilized o-rings to extend the collector in and out. This also enabled us to manually retract the extender without worrying about the motor due to the o-ring slipping against the pulley.					

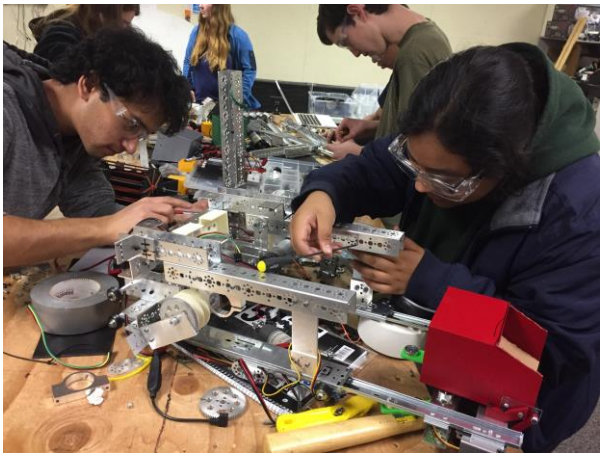
Photos



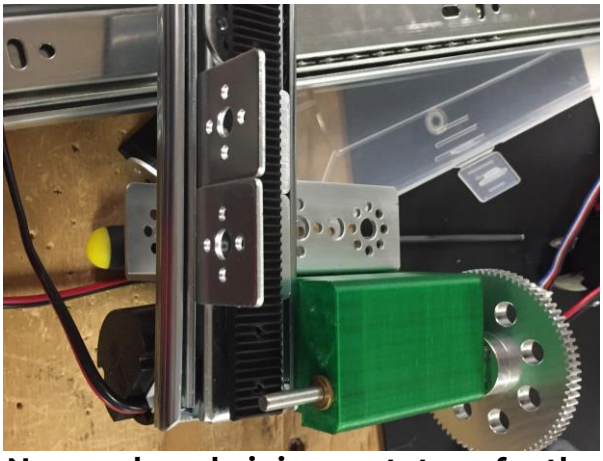
Noah attaching new wheels to the base



Olivia working on reassembling the base for the chassis



Gloria and Ronin disassembling the robot



New rack and pinion prototype for the extender

Week 16 Entries

This week we started work on the new collector and finished building the chassis. We attached our new extender subsystem in order to collect minerals from the crater.

TEAM UNCOPYRIGHTABLE 5135	*January 3, 2019*					*6:00-8:30 PM*
	Strategize	*Design*	***Build***	*Program*	*Test*	*Compete*
Chassis	We continued where we left off and added the chain to the new drivetrain. Sherry and Olivia measured out the chain while Sam focused on attaching the chain to the sprockets.					
Collector	Jay was focused on moving all the VEX components from *Spirit's* collector to the new collector we are utilizing for *Opportunity*. We also added a new gear ratio(36:12 or 3:1) that would further increase torque but maintain the speed we would like for our collection of the minerals. Calculations for this can be found in the Design and Engineering Overview.					
Lift	Ronin and Alex finished drilling holes on the linear slides so we could properly mount them on the robot.					

TEAM UNCOPYRIGHTABLE 5135	*January 4, 2019*					*6:00-8:30 PM*
	Strategize	*Design*	***Build***	*Program*	*Test*	*Compete*
Chassis	We continued work on the chassis of our robot. After our meeting yesterday, we realized that our chassis was not built correctly so Olivia and Sam moved the Tetrix pieces. Jay worked separately on the electronics plate that holds the Rev Hub and servo module. After realizing that the holes didn't line up, Jay created wider holes and used washers to give more room for error when attaching the plate. We decided that we will add the wheel guards/number plates next week and install the camera for sampling.					
Extension Arm	Noah and Jay focused on attaching the full extending collector subsystem to the robot. We realized that because the collector weighed so much due to the motor, there was too much flex and the wrist gears weren't meshing properly. Due to this, we elected to assist the servo with a spring for the wrist mechanism of the					

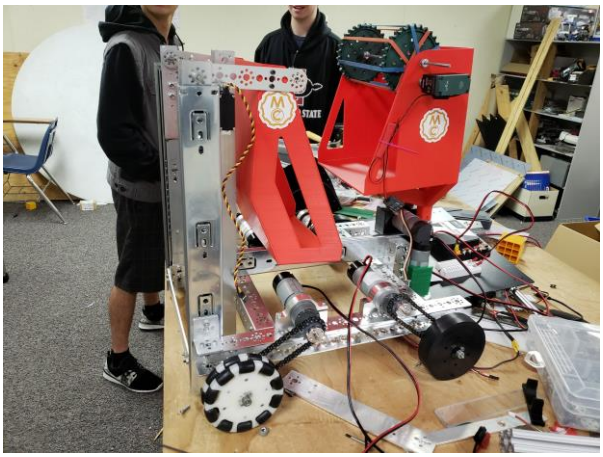
	collector.

Photos

Sam and Olivia working on the chain for the wheels

Noah attaching the collection subsystem to the robot

Alex and Ronin measuring holes for the linear slide



***Opportunity* as of Week 16**

Week 17 Entries

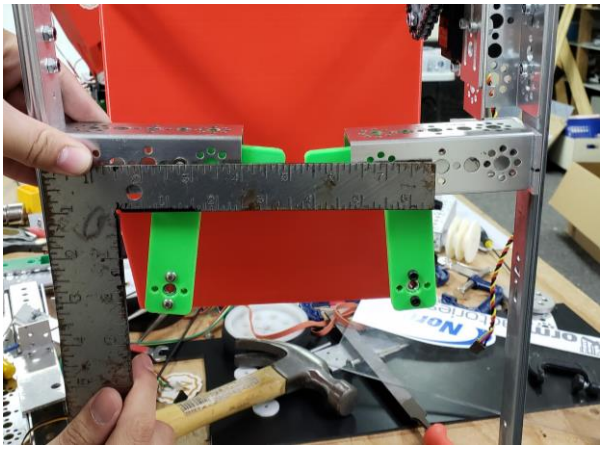
This week we finished making necessary changes to make the robot ready for our second competition. This included a camera for machine vision and finalizing our collector and lift.

TEAM UNCOPYRIGHTABLE 5135	*January 8, 2019*					*6:00-8:30 PM*
	Strategize	*Design*	***Build***	*Program*	*Test*	*Compete*
Collector	Today Noah changed the wrist's motor to a servo. In order to assist the servo in bringing the collector back up, we added a spring which would assist the servo in lifting the collector.					
Lift	Tanner and Ronin worked on securing the linear slides onto the chassis. In order to do this, we fabricated two metal bars that connect directly to the chassis. We also attached our number plates on the same two bars and attached the U-channels for the latch.					

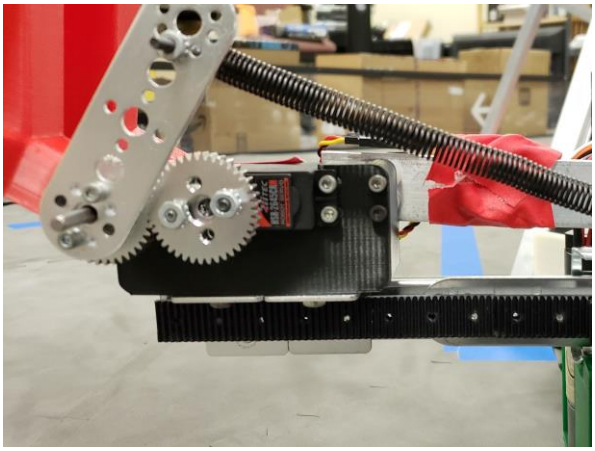
TEAM UNCOPYRIGHTABLE 5135	*January 10, 2019*					*6:00-8:30 PM*
	Strategize	*Design*	***Build***	*Program*	***Test***	*Compete*
Collector	Noah continued to work on the spring assisted mechanism. We found the right length for the spring to work optimally and fabricated a metal bar to attach the spring onto the extender. An issue that we found was that the bar didn't allow rear bucket to lower fully but we plan to fix it in the coming weeks after competition.					
Electronics	Jay dismounted our electronics plate and took it over to the Programming Room so he and Nathan could test if the webcam setup would work. After troubleshooting why the webcam wouldn't work, we found out we needed another Vuforia key when adding a new camera. Once they knew the camera was working properly, Jay took the electronics plate back to the build room so he could attach it to the robot. We decided on using a coiled servo extension cable which attaches to our wrist servo at the end of the extending slide.					

TEAM UNCOPYRIGHTABLE 5135	*January 12, 2019*					*9:00 AM -6:00 PM*
	Strategize	*Design*	***Build***	*Program*	*Test*	***Compete***
League Meet 2: Design39 Campus	Overall Placing: 5th After spending the past couple weeks entirely redesigning the robot, we had to tie up a few loose ends during the morning. Unfortunately due to rushed redesign we found it extremely difficult to latch and lift ourselves onto the lander. Our lift rigging failed consistently and the gears on our lift motor failed to mesh properly under load. Despite this, the primary goal of the redesign, to be able to collect from the crater and score into the lander was successful. We found the the front bucket worked well but the mechanism swayed around while driving due to usage of only a single drawer slide. We were able to secure four matches, only losing two. We scored an average of four minerals in the lander, our primary issue was the servo controlling our rear bucket being unable to lift the bucket with two minerals. Overall we were very satisfied with the performance of the robot due to our limited redesign time and ability to collect from the crater which was the primary goal of the redesign.					
Reflection	Although we are happy with the performance of our robot so far, we are not completely satisfied. Our drivers found difficulty driving with the front bucket folded down due to it continuously hitting the field. Additionally the rear bucket only had enough torque to lift one mineral at a time. Our score cap is much higher now that we can collect from the crater and in the coming weeks we will work to improve and fix our lifting mechanism as well as the rear bucket.					

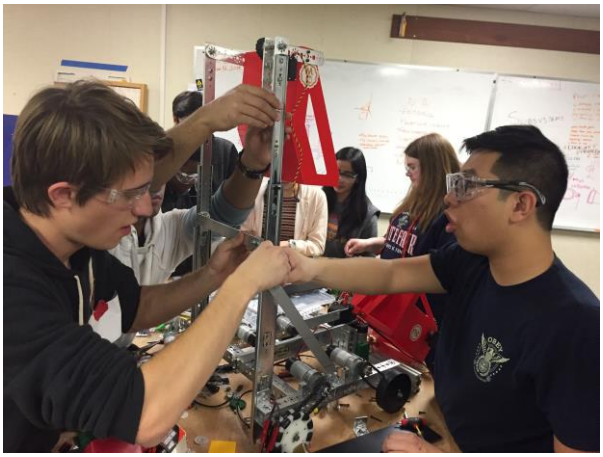
Photos



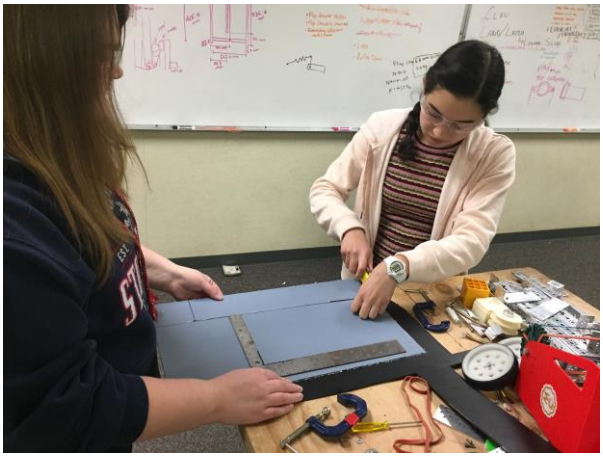
Noah and Jay measuring the gap for the latch



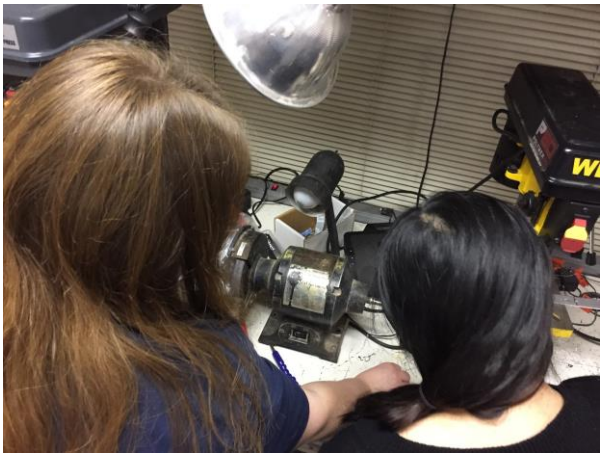
Spring assisted servo for the front bucket



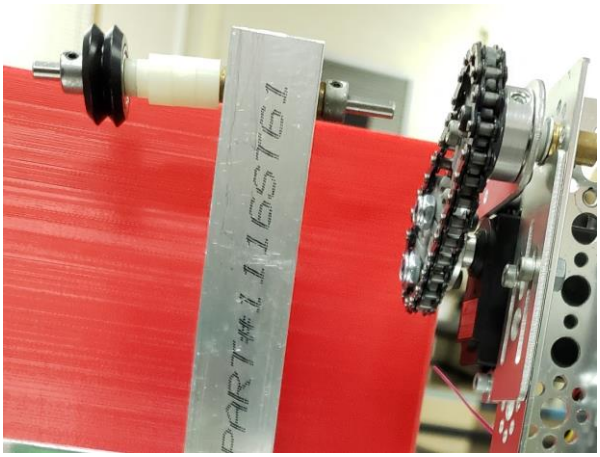
Tanner, Ronin, and Noah reattach the lift onto the robot



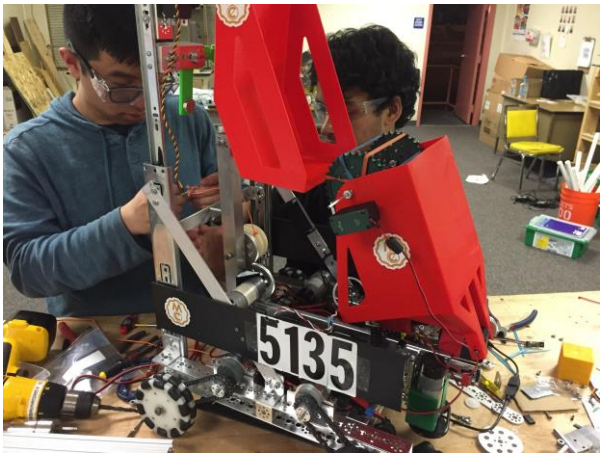
Olivia and Sam making the new number plates



Drilling holes for the number plates



Chain driven rear bucket



Status of the robot heading into league meet 2

Driving training before the matches began

Week 18 Entries

This week we reflected on our second league meet and worked the issues that we found during the competition. We made changes such as new gear ratios and a second slide for the extender.

TEAM UNCOPYRIGHTABLE 5135	*January 15, 2019*					*6:00 -8:30 PM*
	Strategize	*Design*	***Build***	*Program*	***Test***	*Compete*
Reflection	Noah went over what went well during the competition last weekend. The rest of the drive team also gave input to the programmers on what should be changed to the controls. Ronin went over the various issues we faced such as the lift gears not meshing correctly and the lack of support for the front bucket.					
Brainstorm	We came up with ideas to remedy the issues we have on the robot. To fix our gear mesh issues with the lift, we chose to switch to chain so that there is less risk of the lifter not working. We also chose to add a pulley aided guide rail for the extender to better support the front bucket when extending into the crater.					

TEAM UNCOPYRIGHTABLE 5135	*January 17, 2019*					*6:00 -8:30 PM*
	Strategize	*Design*	***Build***	*Program*	***Test***	*Compete*
Rear Bucket	Noah and Sam worked on changing the sprocket ratio for the servo on our rear bucket in order to score two minerals in the lander. We chose to change the gear ratio because we didn't have enough torque at league meet 2 in order to score multiple minerals.					
Extender	Ronin and Alex worked on the guide rail by using small machined metal bars and an extra pulley we kept in from our first robot's lift. We used the pulley as a guide for the rail when it is being extended and in order to keep the tension, we used rubber bands.					

Week 19 Entries

This week we finished making adjustments to our robot and practiced our autonomous and driver control period for our 3rd league meet.

TEAM UNCOPYRIGHTABLE 5135	*January 22, 2019*					*6:00-8:30 PM*
	Strategize	*Design*	***Build***	*Program*	***Test***	*Compete*
Electronics	Today Jay added spacers to lower the electronics plate in order to add a Lexan plate above the electronics and make it easier to alter the wiring. This is meant to fix the issue we had at our second league meet when the minerals got trapped in the wiring because of bad dumps into the rear bucket.					
Extender	Noah finished the pulley aided guide rail for our extender. We had a slight issue with the pinion catching on the uneven slide but after testing, we found that it was not an issue.					
Supports	Ronin and Sherry worked on adding supports to the lifter. They drilled out the holes necessary to mount the bracket we created the morning of our week 17 competition. We also added L brackets to the chassis to further reinforce the lifter.					

TEAM UNCOPYRIGHTABLE 5135	*January 24, 2019*					*6:00-8:30 PM*
	Strategize	*Design*	***Build***	*Program*	***Test***	*Compete*

Wiring	Jay and Alex finished work on the robot's wiring. We made sure that no cables were catching when any of the subsystems were deployed. Sam and Olivia also added an upper plate to the robot so that any minerals that were dropped in the wires wouldn't get stuck.
Lifter	We finished adding supports to the lifter and redid the rigging with new UHMWPE cord. We also made sure that the motor was properly secured and the lift could clear any wires that might get in the way.

TEAM UNCOPYRIGHTABLE 5135

January 25, 2019

6:00-8:30 PM

Strategize	*Design*	***Build***	*Program*	***Test***	*Compete*

Final Adjustments	We finished all the tasks we did not finish last meeting. This included the chain tension for the lift, the front bucket limit, and the camera mount. Our programming team realized that our camera's field of view was not large enough to see all the minerals. Jay and Alex went out to get a wide angle lense kit and we glued the lens mount to the front of the camera.
Autonomous and Driver Practice	During the last hour and a half of our meeting, we tested our autonomous and did crater cycles to see how many points we can score in driver control period. Our autonomous worked for crater side as it could scan the minerals, sample, then park by breaking the vertical plane of the crater.

TEAM UNCOPYRIGHTABLE 5135

January 26, 2019

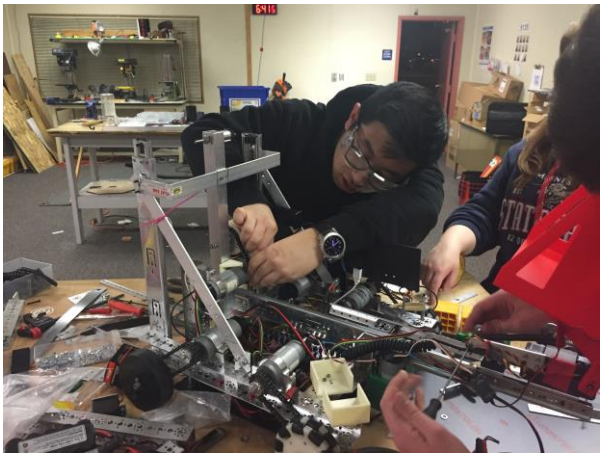
7:00 AM - 1:00 PM

Strategize	*Design*	*Build*	*Program*	*Test*	***Compete***

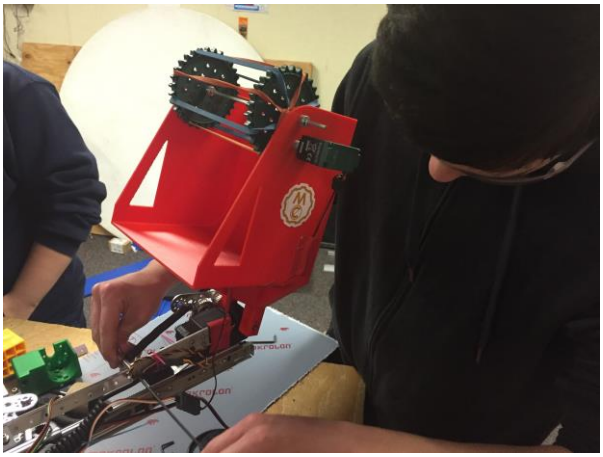
League Meet 3: SET High	*Overall Placing: Finalist Alliance* Despite finishing seventh place, our ability to score in driver control was recognized and we were selected by the third place team to join the second seed alliance. We won our first match in the semifinals and went on to lose the finals by

	only seven points. Although we only won three matches during this league meet, we are extremely satisfied with the performance of our robot. Our sampling and parking autonomous was extremely consistent, and we were able to score an average of seven minerals. We did find that not being able to lower ourselves in the autonomous period proved to be quite the disadvantage. Notable issues included a wheel falling off, and our extension arm belt falling off.
Reflection	Overall we are very happy with our performance as our driver controlled period was ranked well by other teams. According to our Offensive Power Rating(OPR), we were the highest scoring team in the Driver Control Period.

Photos



Noah working on the sprockets for the lift system



Alex attaching the spring for the front bucket

Teams 5135 and 7159 take a group picture after winning finalist alliance in the exhibition matches.

Week 20 Entries

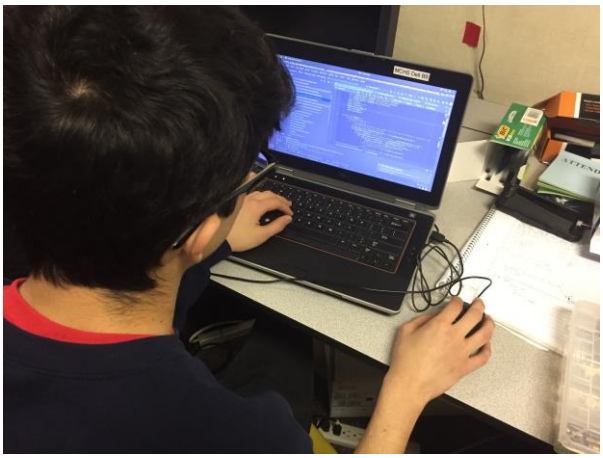
This week we made quick fixes to the robot and shifted our focus to autonomous and preparing for the League Championships.

TEAM UNCOPYRIGHTABLE 5135	*January 29, 2019*					*6:00-8:30 PM*
	Strategize	*Design*	***Build***	***Program***	***Test***	*Compete*
Collector	We replaced the rubber bands on the rubber band collector with new ones. We did this to make sure the rubber bands would not break or snap at competition.					
Assigning Roles for Interview	Roles were assigned for the upcoming judges interview at the next competition. We plan on discussing our outreach, the robots we used to compete (*Spirit & Opportunity*), and the various subsystems we used to complete game objectives.					

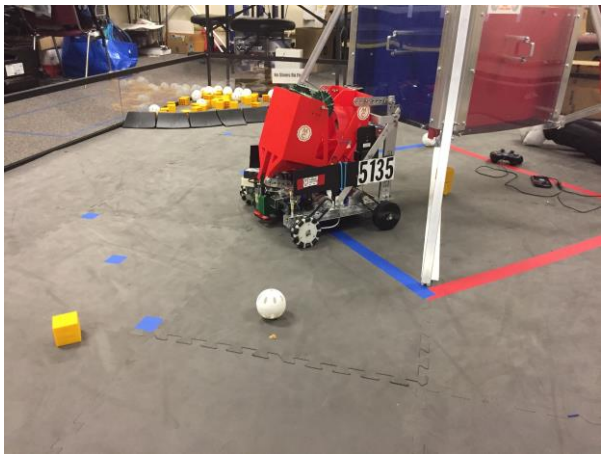
TEAM UNCOPYRIGHTABLE 5135	*January 31, 2019*					*6:00-8:30 PM*
	Strategize	*Design*	***Build***	***Program***	***Test***	*Compete*
Lift	We changed the sprocket ratio to 2:3 in order to keep the robot up while latched. At the last competition, we noticed that the robot would fall back down as soon as we stopped controlling it which would make landing during autonomous impossible with the old 1:1 ratio.					
Latching	We swapped out the old latches with newer ones that are more dense and less likely to flex. This is in order to hold the robot during the start of autonomous as the old latches have been used since *Spirit (*robot V1). We also reinforced the latch mounts to reduce flexing of the Tetrix channels.					
Extension Arm	The o-ring for our pulley system consistently fell off during our matches so to remedy this we decreased the diameter and increased the width, creating a bigger groove for the o-ring.					
Sorter Prototype	We tested the sorter for the minerals. We found various issues with the design as the gold mineral lacked the momentum to get into its respective cargo hold and the silver got stuck in the sorter. We plan on refining the design or omitting the sorter entirely as our collection has gotten significantly better.					

Landing Code	Nathan made some changes to the preliminary autonomous landing code that he initially wrote. He added more encoder counts to compensate for the new sprocket ratio.

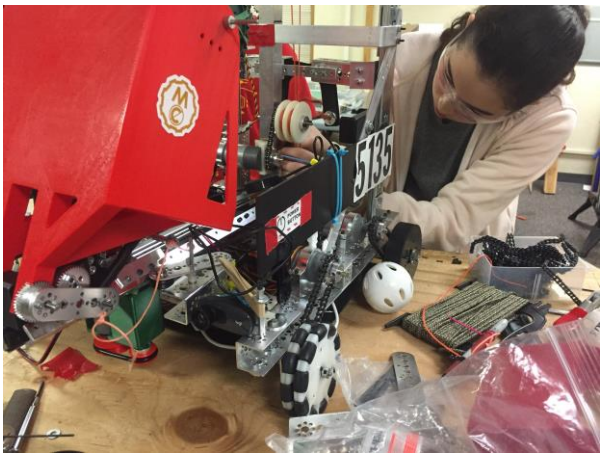
Photos



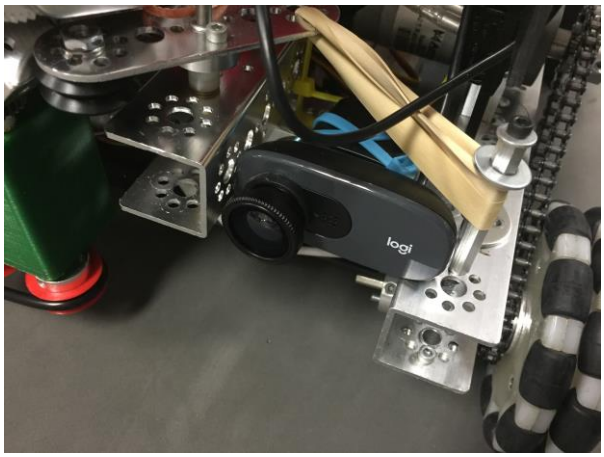
Nathan reviewing the autonomous code for landing



***Opportunity* landing tests**



Sam installing the chain for the revised lifter gear ratio



Webcam with wide angle lens for mineral detection

Week 21 Entries

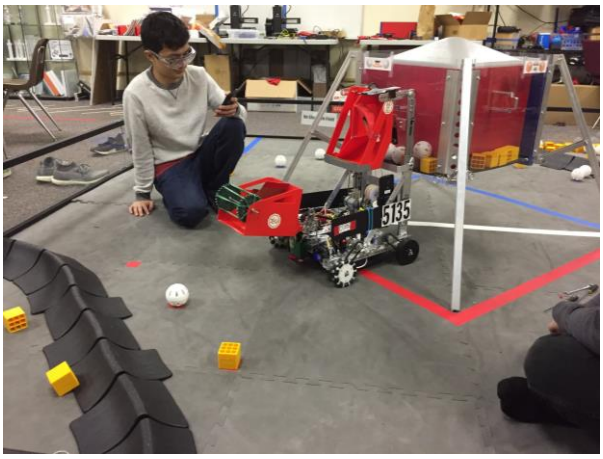
This week we started working on our judges interview and focused on autonomous and driver training. We also installed the final modifications to the robot before league championships on sunday.

TEAM UNCOPYRIGHTABLE 5135	*February 5, 2019*					*6:00-8:30 PM*
	Strategize	*Design*	*Build*	***Program***	***Test***	*Compete*
Judges Interview	During the first half of the meeting, our team got together to work on our judges interview. We planned out what we are going to talk about and practiced our presentation. We found that the time for our presentation was near 10 minutes which was optimal for the interview as it allows judges to ask questions.					
Driver Training	Noah and Jay practiced driver controlled period using the prototype sorter and ramp. The ramp allowed the gold mineral to score into its respective cargo hold and we managed to complete 6 cycles. We plan on 3D printing the final sorter and ramp by next meeting so we can continue driver training.					

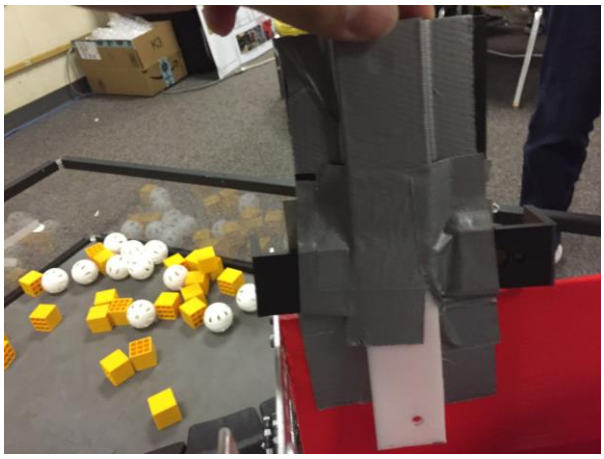
TEAM UNCOPYRIGHTABLE 5135	*February 7, 2019*					*6:00-8:30 PM*
	Strategize	*Design*	*Build*	***Program***	***Test***	*Compete*
Autonomous	We refined our crater side autonomous and fixed the issues with the robot sampling the wrong mineral. The autonomous worked as expected as it managed to land, sample and partially park in the crater.					
Driver Training	We practiced our cycles for driver controlled period. Noah and Jay managed to complete 2 sets of practice before we were required to have a mock interview. We managed to score 7 minerals in the first practice and 8 minerals in the second practice. Noah also brought the final version of the sorter and it worked successfully. During the first set we were limited to 1 mineral after our second cycle because a mineral got trapped in our robot. During end game we tested our latch and found that we were able to hang using only one latch. Overall our driver training was successful and we plan on having more sets during our next meeting before our competition.					

Mock Interview	5135 had a mock interview where we presented our season to our sister team and our mentors. We talked about our robot and the various forms of outreach we did. Afterwards, we had the chance to listen to constructive criticism and learn from our interview.

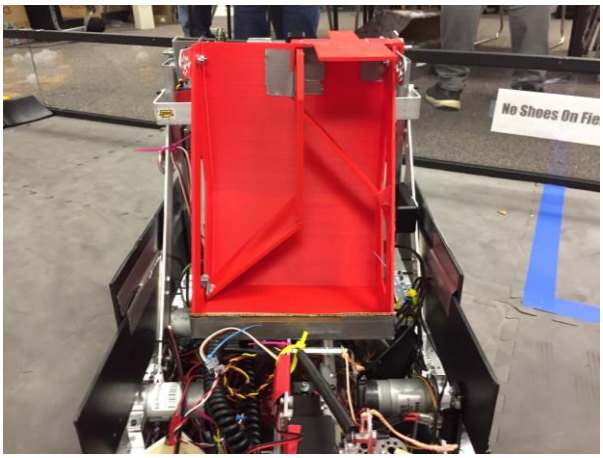
Photos



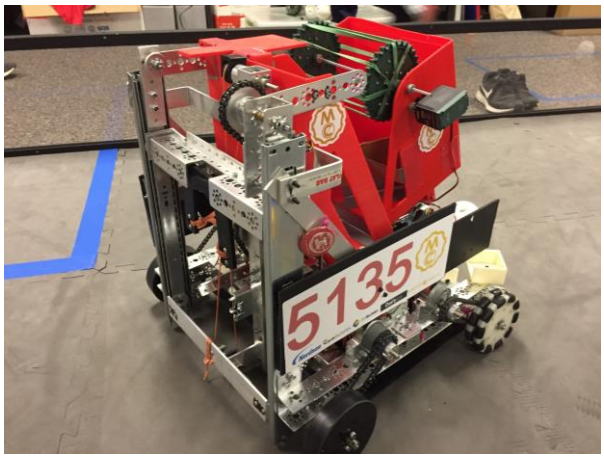
Nathan testing the landing autonomous for *Opportunity*



Prototype ramp for scoring into the gold cargo hold



Rear bucket's final modifications before league championships



***Opportunity* with new number plates that include our gracious sponsors**

Week 22 Entries

This week we brainstormed design ideas for the robot V2.5 upgrade and started prototyping. We also started switching out servos to the REV Smart Servos for the collection and scoring subsystems.

TEAM UNCOPYRIGHTABLE 5135	*February 12, 2019*					*6:00-8:30 PM*
	Strategize	***Design***	*Build*	***Program***	*Test*	*Compete*
Design Improvements	After encountering problems during competition on February 10th we dedicate the first part of the meeting to coming up with ideas on how to solve these problems.					
Prototyping	During the second half of the meeting, we split into smaller groups and started prototyping and sketching our new design improvements. We also made adjustments to the robot to solve the issues the robot had at competition.					

TEAM UNCOPYRIGHTABLE 5135	*February 14, 2019* *PM*					*6:00-8:30*
	Strategize	*Design*	***Build***	***Program***	*Test*	*Compete*
Code Changes	CRServos were changed to Servos in order to accomodate the new REV Smart Servos. New Position enumeration objects were made to easily determine the path robot takes to sample during Autonomous. Depot side code was updated and .					
Added Features	Platforms were made to avoid minerals getting stuck in the robot during the transferring process from the front bucket to the scoring bucket.					

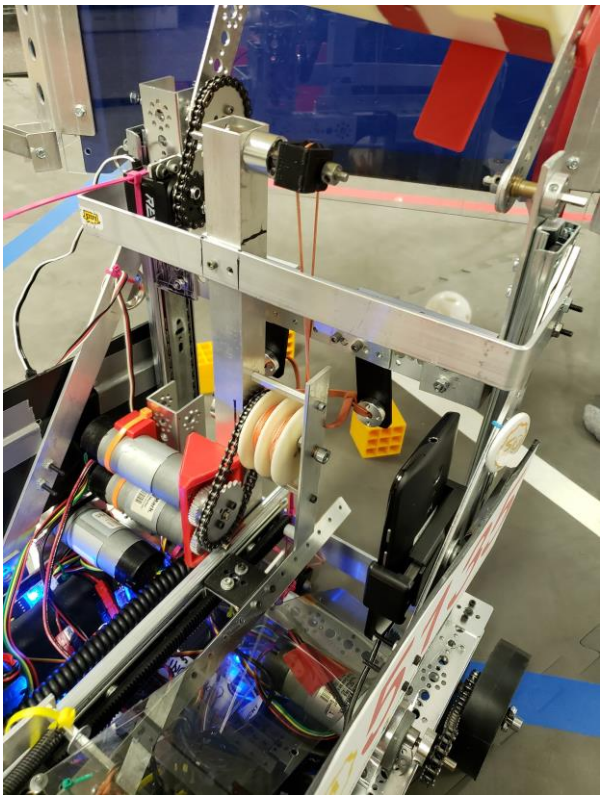
Week 23 Entries

This week we focused on the changes for robot V2.5 such as the lifter and drivetrain. We also had the RoboRavens come and practice during our meeting.

TEAM UNCOPYRIGHTABLE 5135	*February 19, 2019*					*6:00-8:30 PM*
	Strategize	*Design*	***Build***	***Program***	***Test***	*Compete*
Drivetrain	Sherry worked on cutting and measuring out new chain for the drive train. This was done as we needed to switch out a sprocket from the drivetrain motor to the scoring system.					
Lifter	Ronin attached a new gear box onto the lift system. The gear box was added to maintain torque while reducing the gear reduction to prevent the lift system from falling down.					
Plastic Covers	Sam and Olivia worked on cutting plastic covers for the electronic plate. They shaped the plastic with a heat gun. This was to help prevent minerals from getting stuck in the robot.					

TEAM UNCOPYRIGHTABLE 5135	*February 21, 2019* *PM*					*6:00-8:30*
	Strategize	*Design*	***Build***	***Program***	***Test***	*Compete*
Collection	Jay switched out the servo with a smart servo. We also switched the bucket. We switched the front bucket design because cubes were getting on the gears, so shielding was added.					
Drive Train	Sam, Sherry and Olivia worked on putting new chain onto the drivetrain to prepare the robot for testing.					
Team 7159 Robo Ravens	After League Finals, we invited team 7159 Robo Ravens over to our meeting. We helped each other on our robots and were able to test the our robots in the second half of the meeting.					

Photos



Plastic Cover for the Electronic Plate

7159 assisting 5135 with tensioning motors

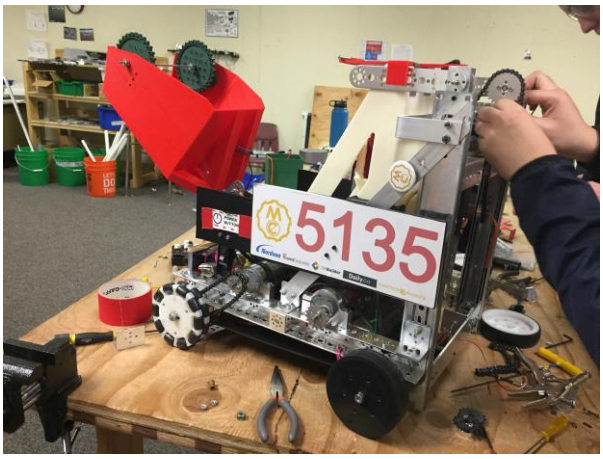
Week 24 Entries

This week we finalized the robot for the regional competition. We also did driver training in hopes of increasing our cycles.

TEAM UNCOPYRIGHTABLE 5135	*February 26, 2019*					*6:00-8:30 PM*
	Strategize	*Design*	*Build*	***Program***	***Test***	*Compete*
Lifter	Ronin replaced the tension system on the sting so that we can easily tension in the middle of competition. Alex drilled holes on the bracket so that new screws can be attached for the i-bolt we are using for the tensioner.					
Collector	Jay fixed the programming on the collector servo so that it would be continuous rotation. He also fixed the rubber bands catching on the VEX axles during collection by making them smaller.					
Mineral Guards	We added mineral guards that Noah 3D printed onto our robot. This gives us increased insurance that minerals wouldn't get trapped under our robot during autonomous. This also has an added benefit of keeping wires within the robot, reducing the chance of wires catching.					

TEAM UNCOPYRIGHTABLE 5135	*February 28, 2019*					*6:00-8:30 PM*
	Strategize	*Design*	***Build***	***Program***	***Test***	*Compete*
Updating Notebook	Jay, Enrique and Sherry worked on updating the notebook for regional competition. They added new information regarding the Robot V2.5 upgrades we made for the regional competition.					
Drivetrain	Sam and Olivia worked on replacing the drivetrain chain so that we can attach metal sprockets in place of the damaged SLA sprockets. Metal sprockets ensured better strength than the plastic ones.					
Lifter	Ronin and Noah worked on the lift while Alex worked on replacing the sprockets on the scoring subsystem servos.					

Photos



Noah Attaching the chain for the scoring subsystem

Mineral Guards