tube.com/watch?v=
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Engineering Notebook

10M

Team Number

Exothermic M________

Team Name

Exothermic Robotics

School

5/6/2024

Start Date

End Date

Book # of

V0.1 – 5.25.24

othermic Donuts

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VRC 2023-2024 Game - Rules & Game Video

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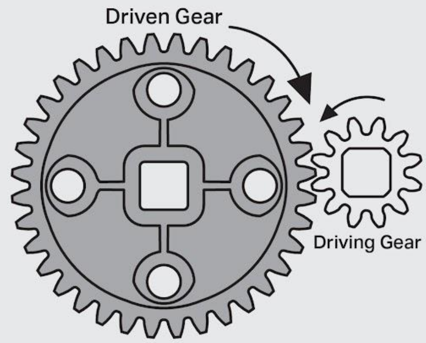
Gear Formulas

Gear Ratio = $\dfrac{\text{\# of Driven Gear Teeth (Output)}}{\text{\# of Driving Gear Teeth (Input)}}$



Power Transfer is a 1:1 gear ratio where the driving and driven gear have the **same number** of teeth.

Increasing Torque (lowering speed) is a gear ratio where the driving gear has **fewer teeth** than the driven gear.

Increasing Speed (lowering torque) is a gear ratio where the driving gear has **more teeth** than the driven gear.

Compound Gear Ratio = (Gear Ratio 1) × (Gear Ratio 2) × (...)

Motion Formulas

Average Speed = $\dfrac{\text{Total Distance}}{\text{Total Time}}$

Rotational Speed = $\dfrac{\text{\# of Turns}}{\text{Time}} = \dfrac{\text{Degrees}}{\text{Time}}$

Power = Force × Velocity

Torque = Force × Distance

Distance is from the **axis of rotation**

Circumference = π × Diameter

π ≈ 3.14

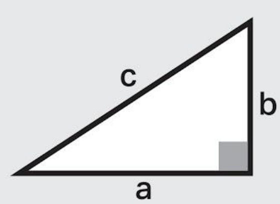
Force = Mass × Acceleration

Mathematical Formulas

Complimentary angles are angles that sum to 90°

Supplementary angles are angles that sum to 180°

Pythagorean Theorem: $c^2 = a^2 + b^2$



1 Pitch = 0.5 in =12.7 mm

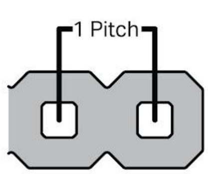


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Table of Contents

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Table of Contents

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Meeting Schedule

All of these times are subject to change depending on work required for success.

Pre Exothermic Robotics Opening - Design

- Sundays - Notebooking and Designing
    - Online meetings including notebooking, CADing, and designing.
    - All team members are attending every meeting.

Summer - Chilling

- Monday - ?????
- Tuesday- ?????
- Wednesday- ?????
- Thursday - ???????
- Friday - ????
- Saturday?????????
- Sunday????????

Winter- Working Hard

- Monday - ?????
- Tuesday- ?????
- Wednesday- ?????
- Thursday - ???????
- Friday - ????
- Saturday?????????
- Sunday????????

Spring - Grinding and throwing everything else out the window

- Monday - ?????
- Tuesday- ?????
- Wednesday- ?????
- Thursday - ???????
- Friday - ????
- Saturday?????????
- Sunday????????

Notebook Key

⚙️ Meeting Details

🗒️ Session Summary

⚠️ Problem

⭐ Ideas

📃 Design

✅ Solution

🔨 Execution

🔍 Reflection

Meet the Team

Aden Norman

Aden Norman, also known as Foreman Norman, has two years of experience with VEX. He attends Tesla STEM High School and enjoys building and coding.

Reyansh Jajoo

This is Reyansh's second year doing VRC. He attends Lake Washington High School and enjoy building and coding.

Thom Kleinpeter

Thom is an interesting individual. It is his second year doing VRC. He attends Eastside Prep and enjoys saying "shrimple."

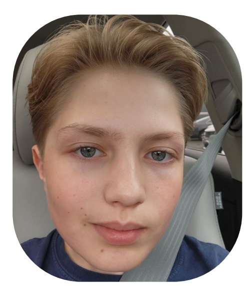
Meet the Team

Dmitriy Yugay

It’s DIMA!!! This is his first year in VEX. He enjoys building and designing and attends Lake Washington High School.

William Chen

This is William’s Second year doing VEX. He attends Eastside Preparatory School. In his spare time, he enjoys playing video games with friends and reading.



Traeger Pacquer

Traeger is also an interesting individual. This is his first year in VRC and he enjoys notebooking. He goes to Juanita High School.

Topic: **Reflection** *Entry by Aden & Reyansh*

Recap of Over Under

🔍 Reflection

Last year, we were Team 938M, a first-year team with no prior experience. Throughout the season, our team learned some important skills that would be extremely helpful if applied this year

Time Management

e. Througho

Crew Resource Management

e. Througho

Topic: **Game Overview and Analysis**

Entry by Traeger and Dmitriy

Overview of High Stakes Game Manual

🔍 Reflection

The VEX V5 Robotics Competition High Stakes is played on a 12'x12' square field, where two alliances, red and blue, each consisting of two teams, compete in matches. Each match comprises a 15-second autonomous period followed by a 1 minute and 45-second driver-controlled period.

The goal is to achieve a higher score than the opposing alliance by scoring rings on stakes, utilizing corner modifiers, and climbing the ladder at the end of the match.

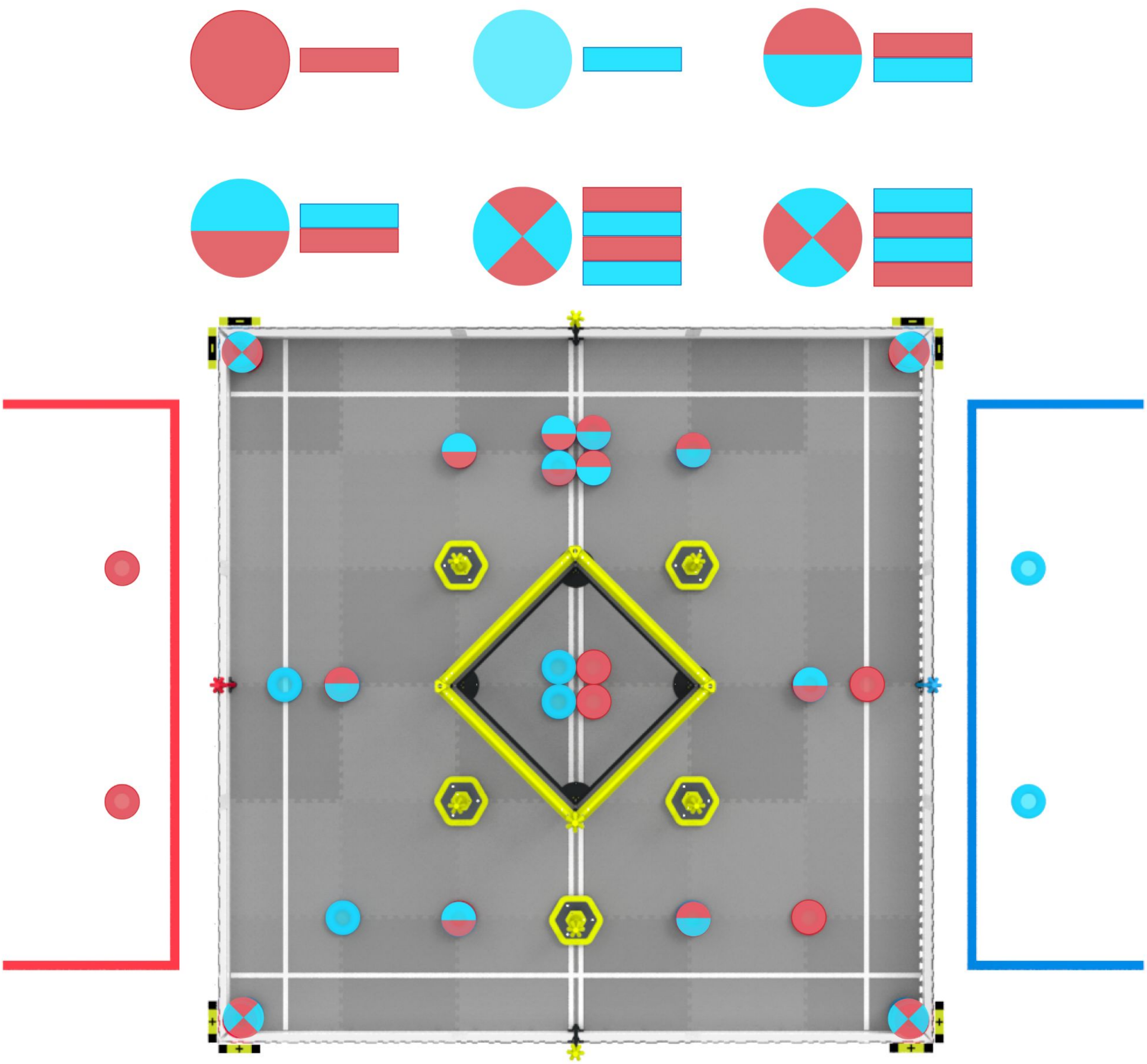
Topic: **Game Overview and Analysis**

Entry by Traeger and Dmitriy

Overview of High Stakes Game Manual

🔍 Reflection

This is how the field should look during head-to-head matches:



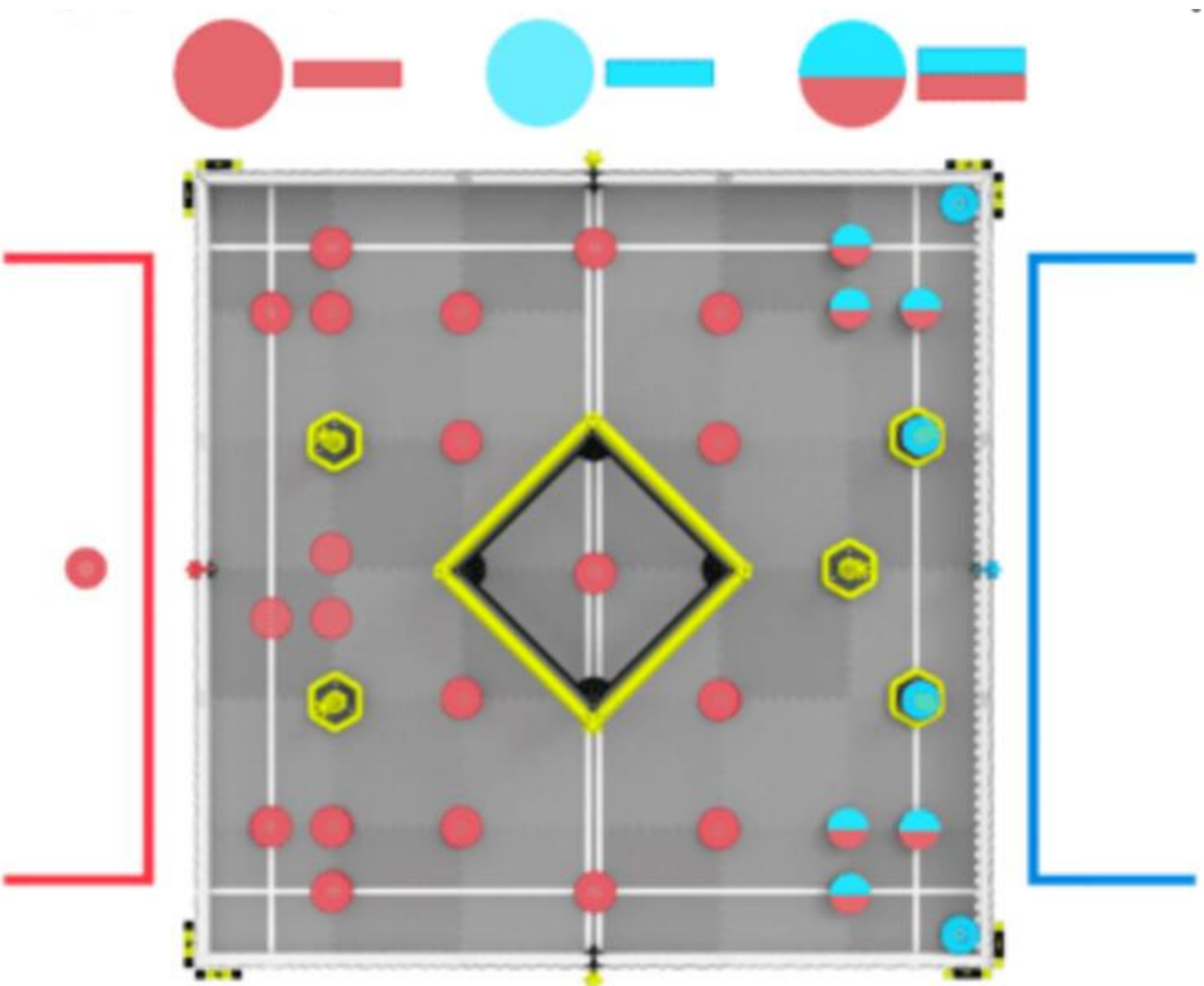
Topic: **Game Overview and Analysis**

Entry by Traeger and Dmitriy

Overview of High Stakes Game Manual

🔍 Reflection

This is how the field should look during skills matches:



1.

Topic: **Game Overview and Analysis**

Entry by Traeger and Dmitriy

Overview of High Stakes Game Manual (cont.)

🔍 Game Specific Definitions

Ring – Torus-shaped objects with specific dimensions

Stake - Vertical PVC pipes used for scoring Rings.

Mobile Goal (MOGO) – Mobile hexagonal objects with a Stake in the center..

Ladder - Central structure with climbing levels and a High Stake at the top.

Corner - 12x12" locations where Mobile Goals can be placed, bounded by field perimeter and tape lines.

Possession and Plowing – Defined statuses for controlling or moving scoring objects.

Autonomous Line – Defined by white tape lines across the field. Robots CANNOT cross these lines during the match.

Entry by Traeger and Dmitriy

Overview of High Stakes Game Manual (cont.)

🔍 Scoring

The points given for completing certain task are as follows:

Autonomous Bonus	6 Points
Scoring a Ring on a Stake	1 Point
Scoring the Top ring on a Stake	3 Points
High Stake Bonus	2 Points for each Robot in the Alliance that got points for a climb
Climb (Level 1)	3 Points
Climb (Level 2)	6 Points
Climb (Level 3)	12 Points
Each Ring Scored on a Stake in a "+" Corner	2 Points
Each Top Ring Scored on a Stake in a "+" Corner	6 Points
Each Ring Scored on a Stake in a "-" Corner	-1 Point
Each Top Ring Scored on a Stake in a "-" Corner	-3 Points

Overview of High Stakes Game Manual (cont.)

🔍 Game definitions

Climbing the Ladder: Robots are only allowed to climb the ladder on their alliances side of the Autonomous line.

Interaction with High Stake: Robots may interact with the High stake much like to how they interact with the autonomous line. Accidental collisions are not uncommon but any deliberate contact that causes damage may result in penalties.

Scoring Rules: During Autonomous Period, Robots cannot contact foam tiles or Scoring Objects on the enemy Alliance's side of the Autonomous Line. Objects and Wall Stakes above the Autonomous Line can be used by both Alliances.

Penalties: Violations of crossing the Autonomous Line or deliberate contact with enemy Robots or elements on their side may result in penalties, including awarding the Autonomous Bonus to the opposing Alliance.

Entry by Traeger and Thom

Overview of High Stakes Game Manual (cont.)

🔍 Game definitions

Vertical Expansion Limit: Robots may not contact or break the plane of more than two Levels of the Ladder at any given time.

Autonomous tasks: They include scoring at least 3 rings on a minimum of two stakes, neither robot contacting/breaking the plane of the starting line, and 1 robot touching the ladder.

Autonomous win points: They are awarded to any alliance that completes four assigned tasks during the autonomous period. Additionally, an autonomous bonus is given to the alliance with the most points at the end of this period.

Make page about game strategy

Topic: **Game Overview and Analysis**

Entry by Traeger and Thom

General Definitions

🔍 General definitions

The following are terms we will use commonly in this notebook.

CAD: Computer Assisted Design

MOGO: Mobile Goal

Drivetrain: The wheels, gears, bracing, and motors which are involved in making the robot move

Wheel Assembly: Wheels with an attached gear usually with a spacer between them

MOGO Clamp/Intake: A mechanism that will grab onto a Mobile Goal

Add a lot more here

Topic: **Role Assignment**

Entry by Reyansh & Dmitriy

May 5th, 2024

Date

Discussion

Meeting Type

⚙️ Meeting Details

Attendance (6/6)

Present: Aden Reyansh Thom William Dmitriy Traeger

Duration
2 hours

Location
Online

🗒️ Session Summary

Today's session focused on assigning team roles and discussing some logistical issues.

⚠️ Who does what?

Before we even start thinking about what our robot is going to look like, we need to organize our team. Every person needs their designated role. A field they specialize in. That way we can guarantee the highest quality work in every aspect of our design process.

Topic: **Role Assignment**

Entry by Reyansh & Dmitriy

May 5th, 2024

Date

⭐ Assigning Roles Based on Experience and Preference

The efficiency of a team strongly depends on the role distribution. If one does something they aren't great at, and don't enjoy, the quality of the work won't be the best, and their skills may go to waste.

In addition to this, our team has two completely new members who may need some time to catch up under the guidance of more experienced members.

This is why when assigning roles, we decided to do it based on experience and preference. This way we can ensure that everyone is having a great time, gaining knowledge, and doing what they're best at.

Now is a great time to meet the crew of 10D.

Topic: **Role Assignment**

Entry by Reyansh & Dmitriy

May 5th, 2024

Date

✅ Final Roles

Traeger Pacquer: Notebooker/Builder

Dmitriy Yugay: Designer/Notebooker

Aden Norman: Builder

Reyansh Jajoo: Builder/Programmer

Thom Kleinpeter: Programmer

William Chen: Builder/Designer

The first role given is their primary role, where their second is where they will assist.

Topic: **The New Game**

Entry by Aden

May 12th, 2024 *(cont.)*

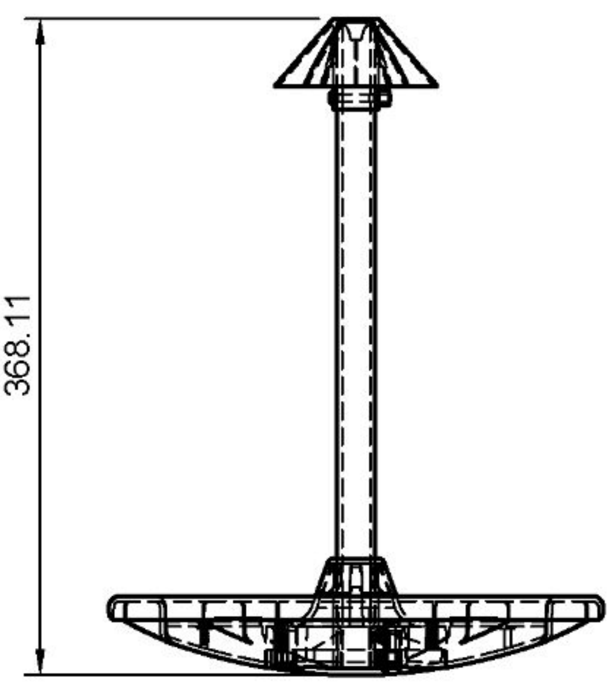
Date

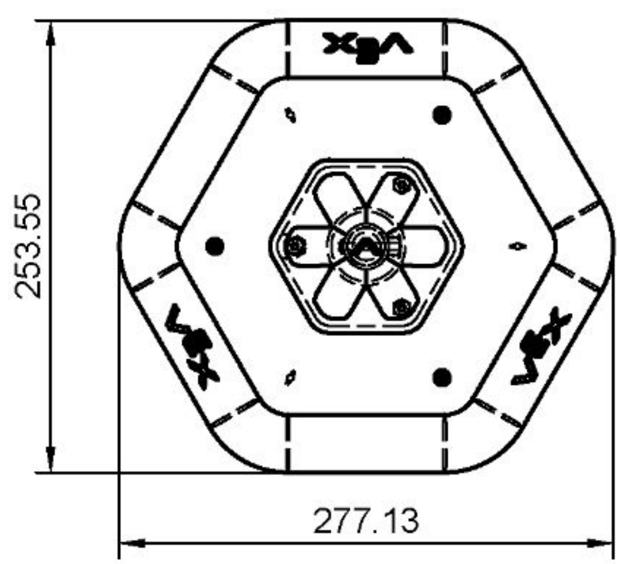
Developing our Game Strategy

When reading the Game Manual, some things that stuck out to us were

- The importance & constraints of corner modifiers
- Vertical & horizontal expansion limits
- The need for a strong, fast robot to manage mobile goals

As each team can only possess one mobile goal at a time, skilled driving and a robust, swift robot is a necessity.





Dimensions of the Mobile Goals (in mm) used in High Stakes. These were helpful in getting a sense of scale for our robot.

Topic: **Designing a Drivetrain** *Entry by Aden & Traeger*

May 19th, 2024

Date

Discussion

Meeting Type

⚙️ Meeting Details

Attendance (6/6)

Present: Aden Reyansh Thom Dmitriy Traeger William

Duration
4 hours

Location
Online

🗒️ Session Summary

Today we discussed which components will allow us to create a robust, fast, and well thought-out drivetrain that can serve us through the early season.

⚠️ What type of drive?

Drivetrains are complicated, and you have to consider the following criteria:

1) Gear ratio
2) Motor Cartridge
3) Wheel Size
4) Motor Amount
5) Wheel Amount
6) C-Channel Orientation
7) Wheel Type

May 19th, 2024 *(cont.)*

Date

⚠️ How many Wheels should the Drivetrain have?

The amount of wheels in a drivetrain play a major role. This includes traction, size of the drivetrain, and maneuverability. Here are the two options we considered.

⭐ Option 1 – A Six-Wheel Drive

A six-wheel drive is maneuverable, and can make very efficient turns when paired with omni wheels. Less wheels can also reduce the weight of the entire robot, making it even faster. Less wheels however, also means less contact area with the ground, reduced traction, and a smaller base. The decreased weight can also end up being a liability, allowing other robots to push around our lighter robot.

Add images here

⭐ Option 2 – An Eight-Wheel Drive

An eight-wheel drive can be less maneuverable, and struggle with friction on turns. However, the extra point of contact makes up for this as it allows increased traction, power, stability, control, and a larger base.

✅ Selected Configuration: Option 2

Though it is true that an eight-wheel drive is less maneuverable and slower, the larger base and increased power is far more important. This years game requires the robot to carry a mobile goal which weighs roughly 2 pounds, with an addition of 0.25 pounds per ring. A stronger drivetrain and larger base would give us balance and

Topic: **Designing a Drivetrain** *Entry by Aden*

May 19th, 2024 *(cont.)*

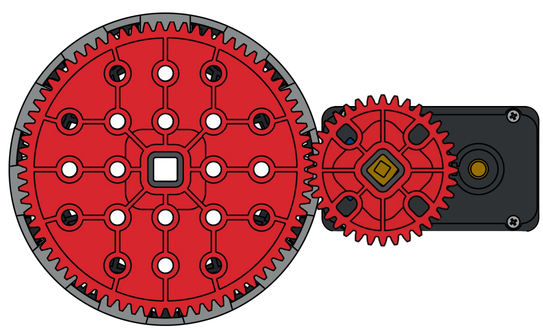
Date

⚠️ What is the Optimal Gear Ratio and Wheel Size?

Choosing an effective gear ratio is important as it determines the speed and torque. The goal is to make the drivetrain as fast as possible, allowing us to score as many points possible, while making sure we have enough torque to move our robot, and the scoring objects. We decided to go for a drive speed of between 300 and 400 rpm, giving us a good balance of speed and torque.

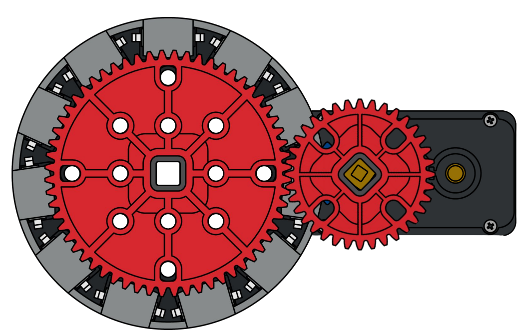
⭐ Option 1 – 36:72 ratio, blue cartridge, 3.25in wheel

This configuration spins at **300 rpm,** and is powered by a blue cartridge motor. It provides a lot of torque to be able to push other robots and manipulate game elements.



⭐ Option 2 – 36:60 ratio, blue cartridge, 3.25in wheel

This configuration spins at **360 rpm,** and is the same as **Option 1** except the 72 tooth gear has been swapped for a 60 tooth.



Topic: **Designing a Drivetrain**

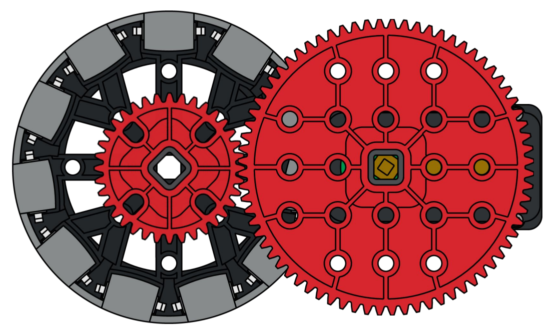
Entry by Aden

May 19th, 2024 *(cont.)*

Date

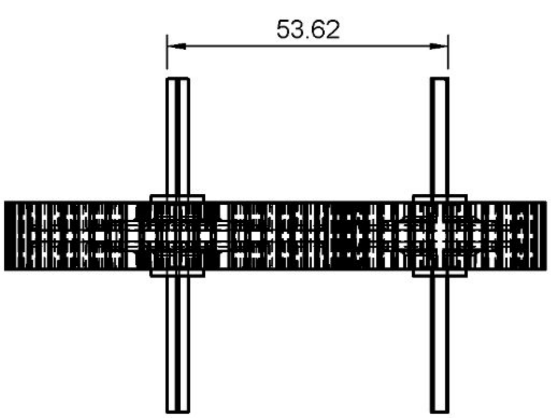
⭐ Option 3 – 72:36 ratio, blue cartridge, 2.75in wheel

This configuration spins at **400 rpm,** and is powered by a green cartridge motor. It provides a respectable amount of speed and some torque to get to scoring objects quickly.

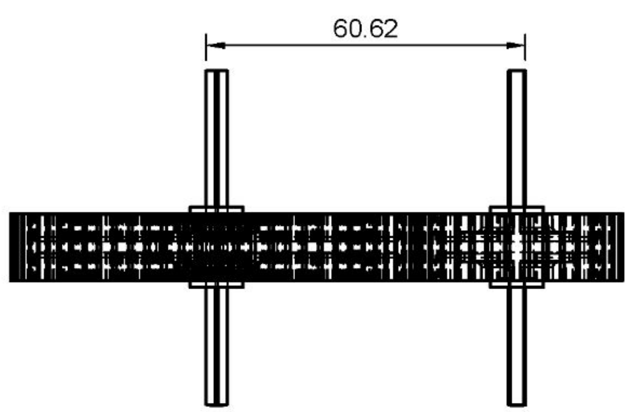


✅ Selected Configuration: Option 2

This drivetrain, driven by a 36:60 gear ratio and a blue cartridge motor (600 rpm) outputs a total of 360 rotations per minute. This paired with a 3.25in wheel gives us a speed of 61.261 in/s. The assembly also uses a small footprint because of the small gear sizes.



36:60 gear ratio (final choice)



36:72 gear ratio

The 36:72 configuration takes up considerably more space than 36:60.

Topic: **Designing a Drivetrain** *Entry by Dmitriy*

May 19th, 2024 *(cont.)*

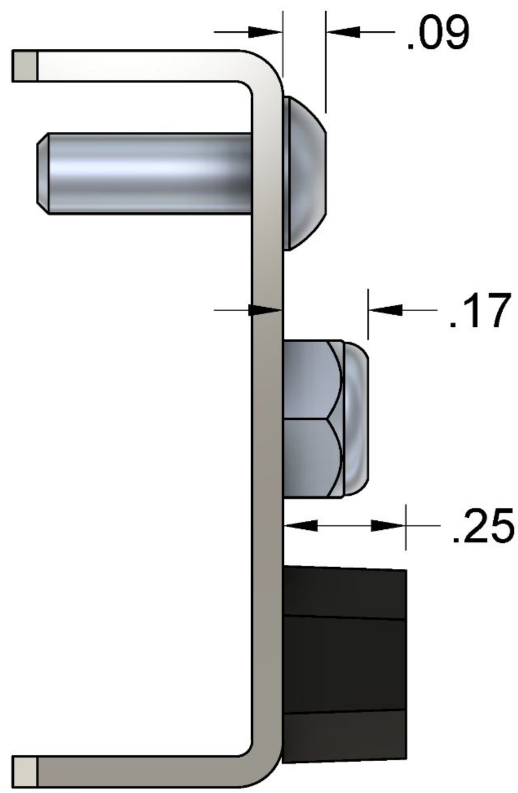
Date

⚠️ C-Channel Orientation

To secure all the components of the drivetrain a c-channel will be necessary, however, the orientation of the c-channel can play a massive role. These are our options.

⭐ Ruling Out Outer C-Channel Orientation

The outer c-channel will be required to have the flat face on the inside. If the flat side was facing outward, these objects would be sticking out significantly, and it could cause them to break, or get caught on other robots or game objects. There are ways to minimize this issue but it will force us to overcomplicate the design for no benefits.



Amount a screw head, thin nylock, and bearing will stick out on the flat side in inches.

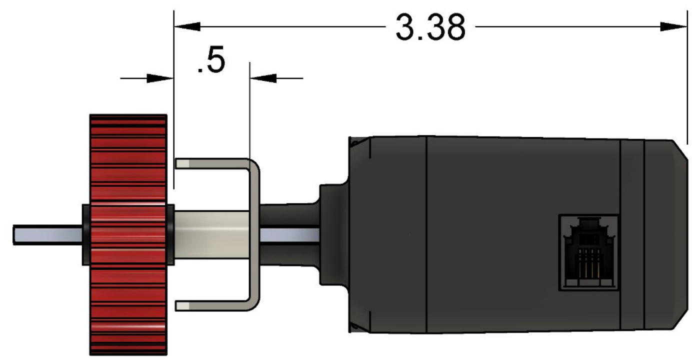
Topic: **Designing a Drivetrain** *Entry by Dmitriy*

May 19th, 2024 *(cont.)*

Date

⭐ Option 1: Inner C-Channel, Flat Side Facing Outward

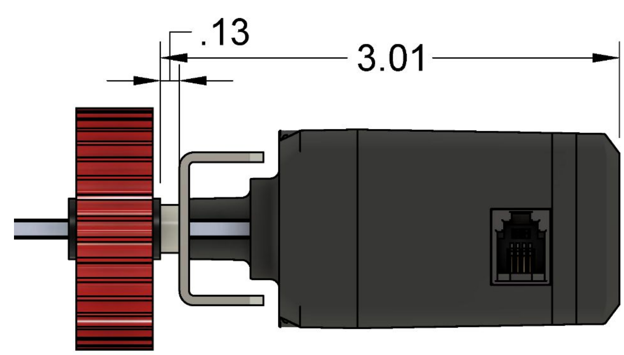
With this option, any bearings can be placed on the inside of the drivetrain instead of the outside, allowing more space for other subsystems. It will also provide a flat face where braces and other systems can be easily mounted to. The downside to this design is that it is more complex, will require more spacing on the inside of the drivetrain, and increase the area taken up by the motors.



The shape of the c-channel will require a 0.5" spacer to be placed in between the channel and gear, pushing the motor back to take up extra space.

⭐ Option 2: Inner C-Channel, Flat Side Facing Inward

With this option, there will be a minimal amount of spacing necessary and motors will take up the least amount of space possible, creating a very simple and easy to build design. The downside is that vertical braces will be difficult to incorporate due to the awkward shape of the channel.



The system requires only a 0.125" spacer in between the channel and gear minimizing the space used.

Topic: **Designing a Drivetrain** *Entry by Dmitriy*

May 19th, 2024 *(cont.)*

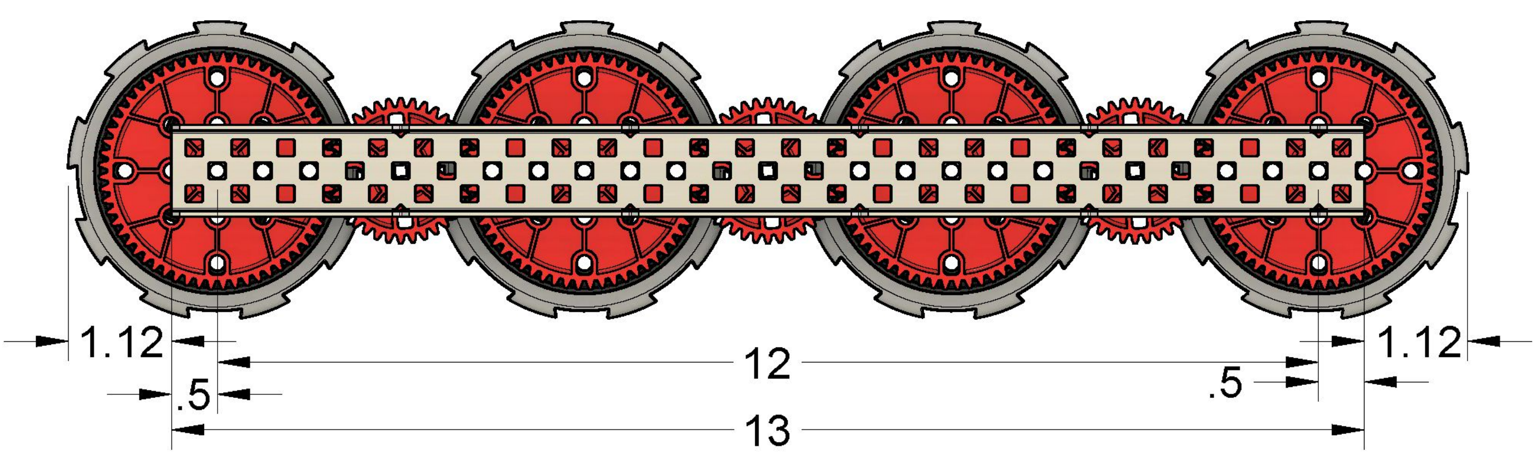
Date

⚠️ The Length of the Drivetrain

The length of the drivetrain will determine the overall size of the robot. This is why choosing the right length is very important. Usually, a larger robot is better because there's more space for complex subsystems, but it is important the drivetrain isn't too long. Our robot is limited to 18 inches in length, and because some subsystems will stick off the base, such as the ring intake, we need to leave a little extra room.

✅ Calculating the Optimal Length Drivetrain

To find the optimal length, we need to know the minimum length of the drivetrain with our current configurations. With our chosen 36:60 gear ratio, the motor and wheel axles need to be 2 inches or 4 holes apart. This with an eight-wheel drive, makes a minimum length of 25 holes, but since we are planning on using the middle holes of a c-chanel, we will need at least a 26x1x2x1 c-channel.



Topic: **Designing a Drivetrain**

Entry by Dmitriy & Reyansh

May 19th, 2024 *(cont.)*

Date

⚠️ How many Motors should the Drivetrain have?

The amount of motors used in a drivetrain can make a significant difference. A single robot is limited to a total motor power of 88W. The more power we dedicate to our drivetrain, the less power we would have left for other subsystems. These are the three designs which offer the best balance:

⭐ Option 1 – 44W Drivetrain with 4, 11W Motors

This configuration would allow 44W to be used on other subsystems, in exchange for a weaker drivetrain. Last season in Over Under, we utilized this configuration, which allowed us to get the most out of our other subsystems, but the stress on our 44W drivetrain led it to fail at times.

⭐ Option 2 – 66W Drivetrain with 6, 11W Motors

This configuration would allow 22W of power for other subsystems while maintaining a fairly strong drivetrain that can easily traverse the field, with minimal risk of overheating. A very basic design used by many.

Add images here

Topic: **Designing a Drivetrain** *Entry by Dmitriy*

May 19th, 2024 *(cont.)*

Date

⭐ Option 3 – 88W Drivetrain with a PTO

This configuration would allow all 88W of power to be directed toward the drivetrain, increasing the power significantly. In order to run other subsystems, an **Independent PTO** would be utilized, allowing us to temporarily redirect power from the drivetrain, to another subsystem. The design however, is significantly more complicated and requires more moving parts. This can increase the chance of mechanical issues.

Add images here

✅ Selected Configuration: Option 2

This early into the season, we see only two subsystems where a motor could be used. This is the ring intake, and possibly a lift to get the higher neutral and alliance stakes. Utilizing a 44W drive wouldn't be smart because we are planning on using only 22W on other subsystems making it smarter to just implement a 66W drive instead. An 88W drivetrain with a PTO is an option to consider, as it would provide a much stronger drivetrain, with the only downside being a more complicated system. For this reason, we decided to stick with a simpler 66W drivetrain, and make the leap to an 88W drivetrain later in the season, if we deem it more effective.

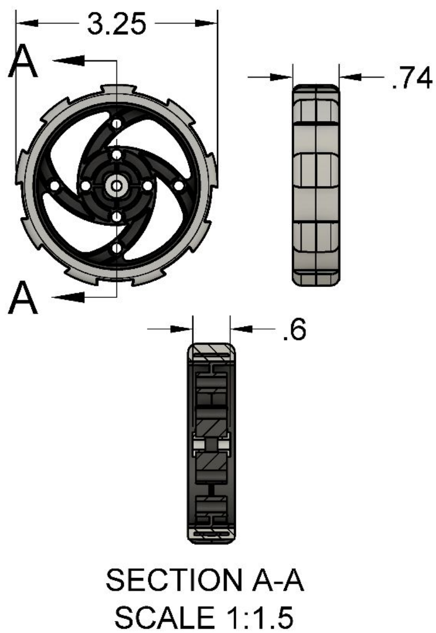
Topic: **Designing a Drivetrain** *Entry by Dmitriy*

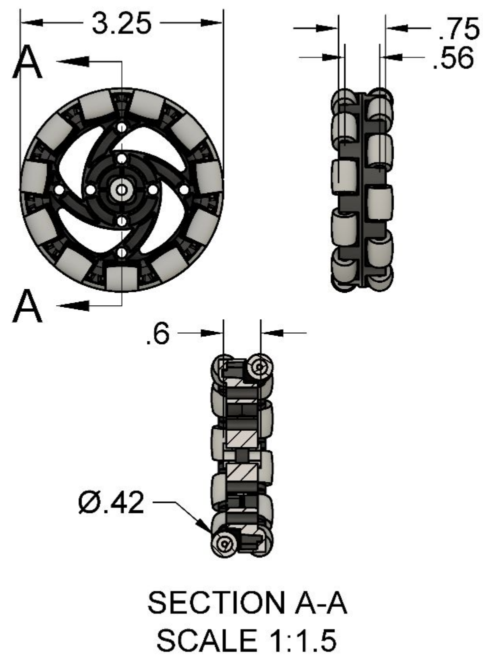
May 19th, 2024 *(cont.)*

Date

⚠️ The type of wheels

The type of wheels used and their positioning are very important. There are two primary wheel types we can use. Omni wheels, and traction wheels.





Traction wheels are standard wheels with a rubber outer shell, and indents throughout the circumference of the wheel. This allows great traction, however, it can also cause lots of friction on turns.

Omni wheels have “rollers” along the edges of the wheel. These rollers are positioned perpendicular to the turning direction of the wheel, allowing it to freely glide sideways. This can significantly reduce the friction on turns.

Topic: **Designing a Drivetrain**

Entry by Dmitriy & Reyansh

May 19th, 2024 *(cont.)*

Date

⭐ Option 1 – All Omni Wheels

This configuration minimizes friction when turning, but completely gives up traction. Such a lack of traction makes the robot prone to slippage, negating the benefits of our high torque drivetrain.

Insert a full omni drawing

⭐ Option 2 – Omni, Omni, Traction, Omni

This configuration negates some of the issues that come with **Option 1** by replacing one of the central omni wheels with a traction wheel. This traction wheel prevents drift, while maintaining low friction turns.

Insert a Omni omni traction omni drawing

Topic: **Designing a Drivetrain**

Entry by Dmitriy & Reyansh

May 19th, 2024 *(cont.)*

Date

⭐ Option 3 – Omni, Traction, Traction, Omni

This configuration combines the benefits of traction and omni wheels. The omni wheels reduce friction on turns while the traction wheels provide good traction, negating the issues that come with omni wheels. This does however cause more friction than **Option 1** and **Option 2**.

Insert a omni traction traction omni drawing

✅Selected Configuration: Option 3

The traction wheels in this configuration, work very well with our chosen gear ratio. With this combination, we will have a strong drivetrain that can effortlessly plow scoring objects, while still maintaining effective turns.

Topic: **Designing a Drivetrain**

Entry by Dmitriy & Reyansh

May 19th, 2024 *(cont.)*

Date

✅Drivetrain Specs Summary

To summarize, we chose an 8 wheel, 360 RPM drivetrain with omni wheels on the outer wheels and traction wheels in the middle. This drivetrain would also have a plastic funnel on the front so it will be easier for the driver to intake rings.

Topic: **Modeling** *Entry by Traeger & Aden*

May 26th, 2024

Date

Discussion

Meeting Type

⚙️ Meeting Details

Attendance (5/6)

Present: Aden Reyansh Thom Dmitriy William
Absent: Thom

Duration

4 Hours

Location

Online

🗒️ Session Summary

The duration of this session was spent on finalizing each members’ roles. The driver has yet to be decided.

We also continued designing the drivetrain as a group, considering:

- The spacing between components
- The type of front wheel cover/brace
- Bracing type and positioning
- The positioning of the motors

Topic: **Designing a Drivetrain** *Entry by Dmitriy*

May 26th, 2024 *(cont.)*

Date

⚠️ Shafts vs. Screw Joints

When creating a drivetrain, minimizing the friction is crucial. The lower the friction, the less force is needed rotate the wheels.

⭐ Calculating the Minimum Width of the Drivetrain

To calculate the most narrow possible drivetrain we can simply take the dimensions of every part necessary in the drivetrain and add them together. These parts include the wheels, gears, spacers to reduce friction, and the c-channels.
Afterwards we can round up to the nearest 0.5 inch to make sure the holes can align.

Topic: **Designing a Drivetrain** *Entry by Reyansh & Dmitriy*

May 26th, 2024 *(cont.)*

Date

📃 Modeling the Drive Train: The Frame

While discussing the optimal design of a drivetrain frame, our team stressed the importance of multiple characteristics. One of these was:

⚠️ The Width of the Drivetrain

We need the drivetrain to be as narrow as possible as it will provide more space for other subsystems.
However, we need to make sure the c-channels that encase the wheels and gears of the drivetrain are at a distance that is perfectly divisible by a pitch. This would make sure that holes of parts perpendicular to the drivetrain would align with the drivetrain c-channels.

⭐ Calculating the Minimum Width of the Drivetrain

To calculate the most narrow possible drivetrain we can simply take the dimensions of every part necessary in the drivetrain and add them together. These parts include the wheels, gears, spacers to reduce friction, and the c-channels.
Afterwards we can round up to the nearest 0.5 inch to make sure the holes can align.

Topic: **Designing a Drivetrain**

Entry by Reyansh & Dmitriy

May 26th, 2024 *(cont.)*

Date

✅ Dimensions of Parts and Narrowest Drivetrain Design

Insert a drawing of wheels and gears and spacers and shit ← potty word :((

Pottu wpord

Topic: **Designing a Drivetrain**

Entry by Dmitriy

May 26th, 2024 *(cont.)*

Date

⚠️ What Type of Wheel Covers?

Front and back wheel covers can prevent alien objects from interacting with the drivetrain's moving parts. However, these wheel covers can take up lots of additional space, and add a lot of weight to the robot, both things we do not want. The question becomes, are they worth their benefits or not?

⭐ Option 1: No Wheel Covers

Utilizing a design with no wheel covers would reduce weight, but it could also result in numerous issues such as scoring and field objects getting stuck in front of the robot.

Insert a render of a drivetrain with no wheel covers

Topic: **Designing a Drivetrain** *Entry by Dmitriy*

May 26th, 2024 *(cont.)*

Date

⭐ Option 2: Flat Wheel Covers

Utilizing a flat wheel cover will prevent objects from going into the drivetrain mechanism. Objects that come in collision with it will be pushed either inward toward the robot, or outward away from it.

⭐ Option 3: Funnel Wheel Covers

Utilizing a funnel in the will prevent objects from going into the drivetrain mechanism, and instead make them go inward toward the center of the robot. This can be very useful if we are trying to intake scoring objects.

✅ Selected Configuration: Option 2 and 3

Utilizing a funnel in the front would be very beneficial, as it would allow us to intake rings much more easily. This can make the driver's job a lot easier.

Guys idk if we are doing anything in the back near the mogo mech yet so whe we figure it out we do this k

Topic: **Designing a Drivetrain**

Entry by Dmitriy

May 26th, 2024 *(cont.)*

Date

⚠️ What Material

Selecting the right parts and materials to use for creating the wheel cover is very important. Some parts and materials are more prone to breaking or deforming. Some may also require more space to be used.

⭐ Option 1: Standoff Funnel

One way to construct a funnel is utilizing standoffs and shaft collars. Standoffs are fairly durable and are very unlikely to bend or break. They are also not as heavy. The one downside to this design is that a large hole is left the drivetrain frame, and though it is very unlikely, some game objects can get caught in it.

⭐ Option 2: Plastic Funnel

Another way to construct a funnel is utilizing plastic, and then boxing it for extra strength. The plastic by itself is very weak. Any collisions will easily break it, This is why boxing is crucial. The problem with this, is that lots of screws and nuts will be necessary, increasing the weight significantly.

⭐ Option 3: Channel Funnel

Utilizing a whole c-channel for the the funnel can create a very durable and strong funnel, however, it will be a lot heavier than all the other options

Topic: **Designing a Drivetrain** *Entry by Dmitriy*

May 26th, 2024 *(cont.)*

Date

✅ Selected Configuration: Option 2

The plastic wheel cover is going to be utilized due to its multiple benefits. A channel funnel is very bulky and takes up a lot of space, while also being fairly heavy, and the standoff funnel is too open and we were afraid of entanglement with other robots due to the large gap. In addition to this, we found the plastic funnel to be aesthetically pleasing.

Topic: **Modeling**

Entry by Traeger & Aden

June 3rd, 2024

Date

Discussion

Meeting Type

⚙️ Meeting Details

Attendance (5/6)

Present: Aden Reyansh Dmitriy Thom
Absent: William Traeger

Duration
3 Hours

Location
Online

🗒️ Session Summary

The duration of this session was spent on designing the drivetrain. We considered:

- The positioning of the motors
- Bracing type and positioning

⚠️ What is the Optimal Motor Placement

Motors take up a large amount of space, and improper placement can leave not enough space for other subsystems and braces. This is why it is so important to have proper motor placement and orientation.

Topic: **Designing the Mobile Goal Intake** *Entry by Dmitriy*

June 12

Date

Design

Meeting Type

⚠️ What type of intake?

The next thing we had to do was to make a MOGO intake.The ability to control and manipulate the position of a mobile goal is crucial in the new game. In order to do this effectively, our robot requires an intake system.

Topic: **Designing the Mobile Goal Intake**

Entry by Dmitriy

June 12

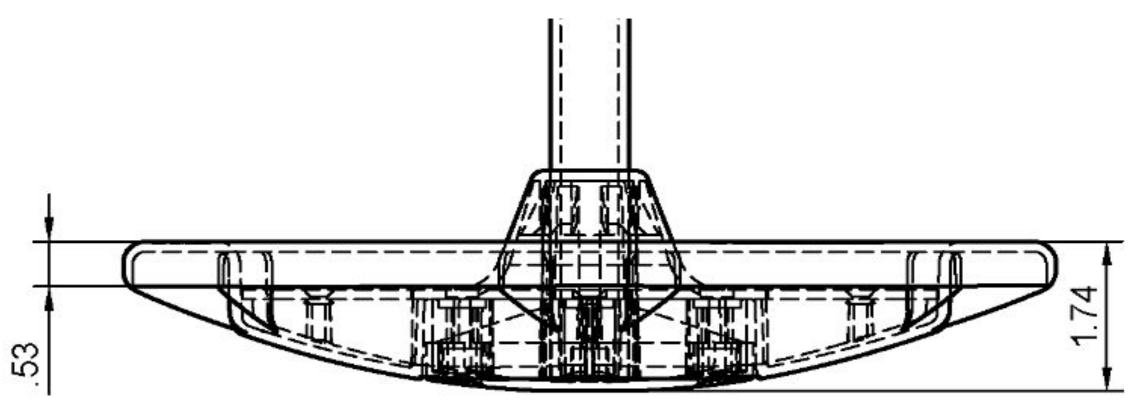
Date

Design

Meeting Type

⭐ Option 1 – Double acting piston, retract to clamp

This configuration would utilize a double acting piston meaning there would be no idle position.



Topic: **Designing the Mobile Goal Intake** *Entry by Dmitriy*

June 12

Date

Design

Meeting Type

⭐ Mobile Goal clamp options

We took inspiration from other designs and decided to utilize a system in which a bracing would slightly prop the mobile goal up to be then pushed down on by a clamp to elevate the entire mobile goal off the ground while also tilting it slightly toward the robot.

To create the most efficient and effective design, accurate measurements are necessary. It allows us to find dimensions of certain objects through math, rather than what looks right. It guarantees that no issues can occur, and that the design is optimal.

Topic: **Designing the Mobile Goal Intake** *Entry by Dmitriy*

June 12–June 18

Date

Design

Meeting Type

Calculations:

To aid the design process of our mobile goal intake, we decided to create a function that would allow us to pinpoint the vertical distance the mobile goal is off the ground at any given point, since we didn't have game elements yet. We came up with the function:

$$y=0.0435...x^2$$

In this function, (y) is the vertical distance the mobile goal is off the ground, at (x) units from the center.

We obtained this function by comparing the arch of the mobile goal to a parabola. The function to a parabola is $y=ax^2$, where (y) is the y-coordinate of a point, (x) is the x-coordinate of that same point, and (a) is the distance from the vertex to the focus. To obtain a function that could represent the curvature of the mobile goal, we could utilize any singular point we already know of, and then plug it in to find the (a) value.

Topic: **Designing the Mobile Goal Intake** *Entry by Dmitriy*

June 12–June 18

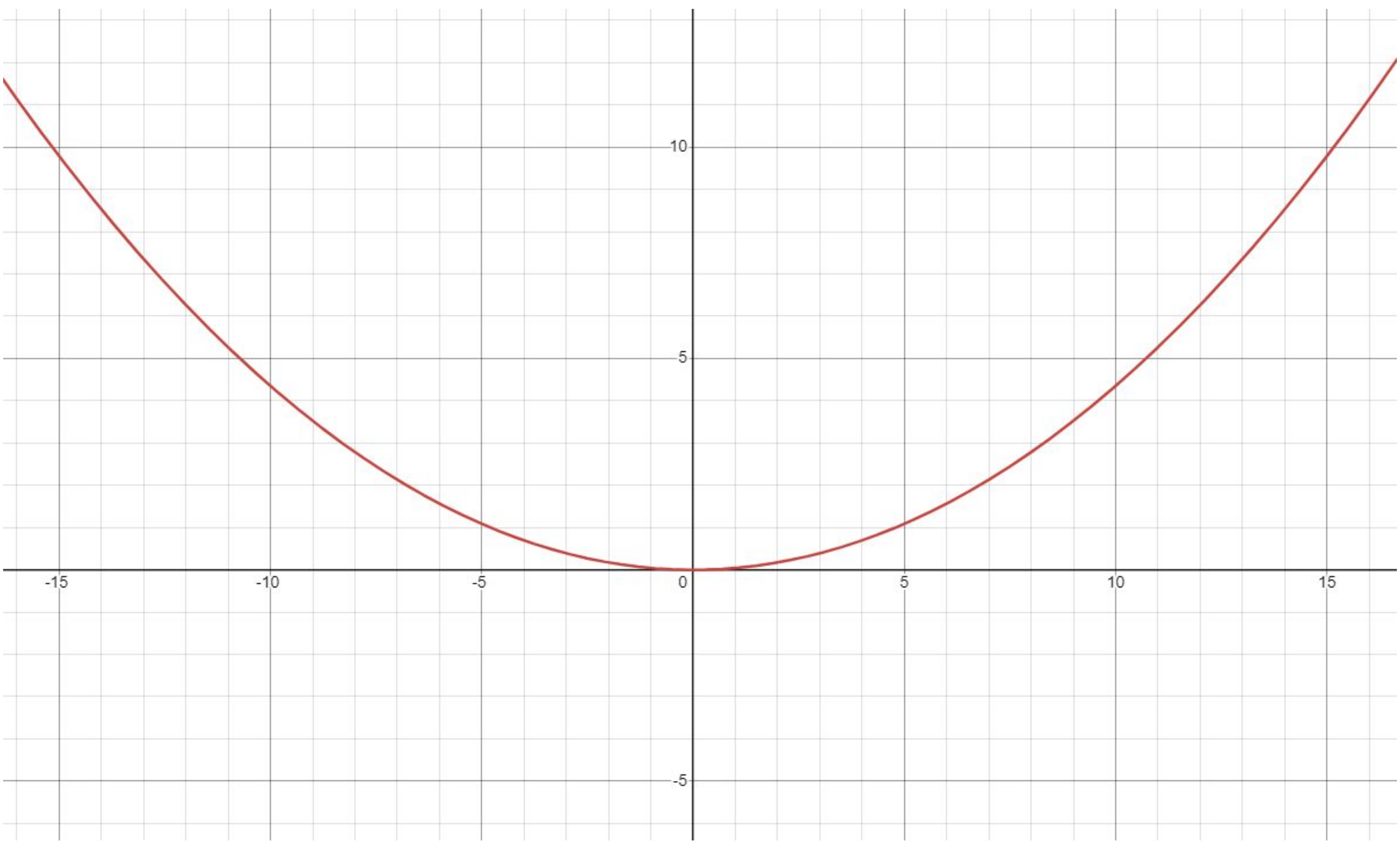
Date

Design

Meeting Type

Calculations (cont.) :

Unfortunately the curvature of the mobile goal cannot be represented by a parabola perfectly but our function had a maximum error of less that 0.05 inches which we deemed accurate enough, considering our design should be able to account for such small imperfections.



Topic: **Designing the Mobile Goal Intake**

Entry by Dmitriy

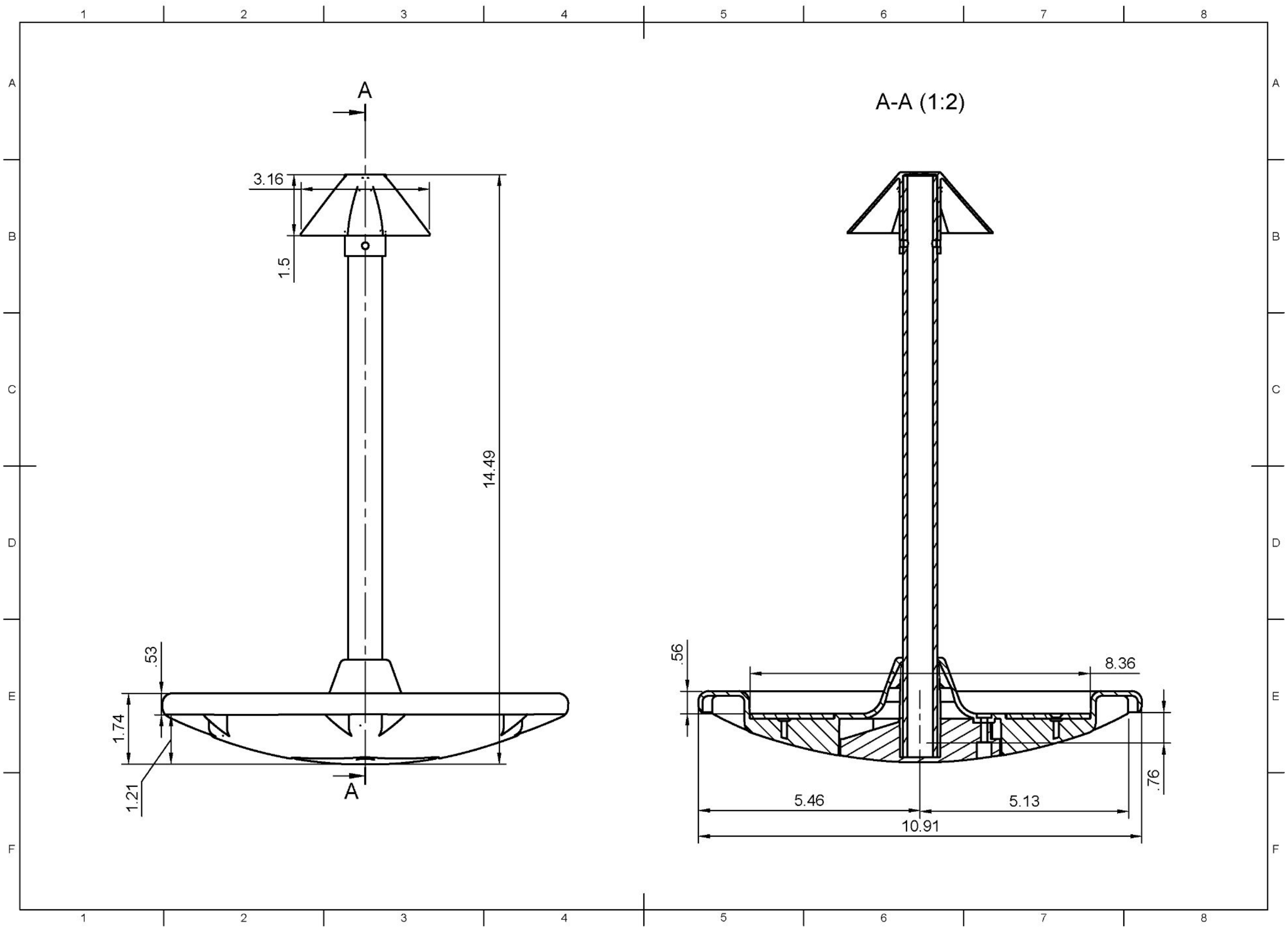
June 12–June 18

Date

Design

Meeting Type

In Depth Dimensions of Mobile Goal



The drawing on the left displays the mobile goal and its primary dimensions. On the right is a section view of the mobile goal displaying in depth dimensions that we utilized for the modeling of our intake.

Topic: **Planning**

Entry by Dmitriy

June 22nd, 2024

Date

Discussion

Meeting Type

⚙️ Meeting Details

Attendance (3/6)

Present: Aden Reyansh Dmitriy
Absent: Traeger Thom William

Duration
1 Hours

Location
Ignite Robot House

🗒️ Session Summary

During this meeting, we were given an overview of facility policies, and provided with an organization issued box, brain, controller, and battery, alongside a robot from last year to disassemble for parts. We also got to meet Adi, the Exothermic Co-President.

Afterwards, we got to see the Quantum facility at which we will be working for the rest of the summer.

Insert Quantum photos here

Topic: **Socializing** *Entry by Dmitriy*

June 24th, 2024

Date

PARTY :)

Meeting Type

⚙️ Meeting Details

Attendance (3/6)

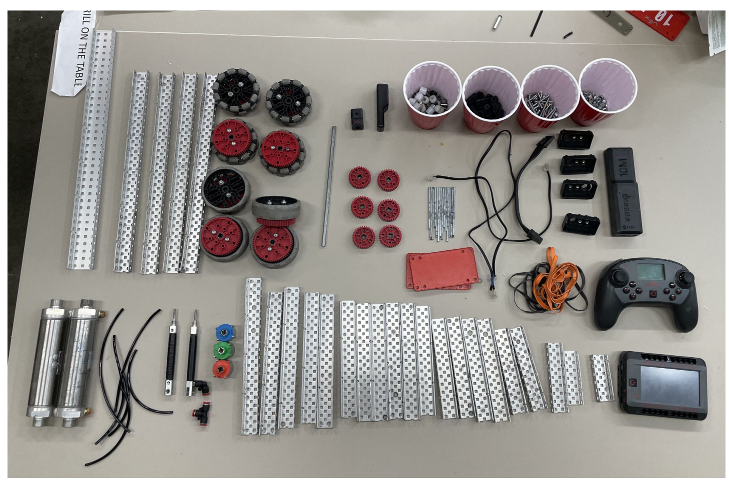
Present: Aden Reyansh Dmitriy
Absent: Traeger Thom William

Duration
5 Hours

Location
Idylwood Park and Quantum Facility

🗒️ Session Summary

During this session, we attended a banquet at which we met the other Exothermic teams who we will be working with throughout the season. Afterwards, our team went to the Quantum facility to disassemble our provided old robot and organize parts to prepare for the construction of our robot. This "robot carcass" was devoid of any motors, didn't have many long c-channels, and had little pneumatics.



These were all the parts on the "robot carcass" which we disassembled.

Topic: **Building**

Entry by Thom

June 30th, 2024

Date

Building

Meeting Type

⚙️ Meeting Details

Attendance (4/6)

Present: Aden Thom Traeger Dmitry
Absent: William Reyansh

Duration

5 Hours

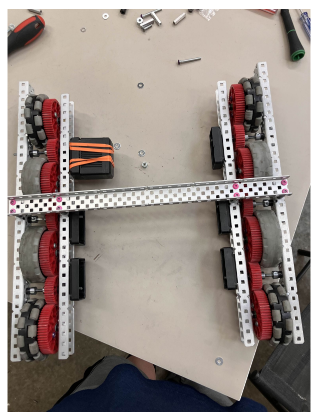
Location

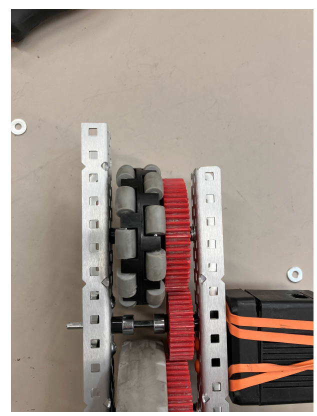
Quantum Facility

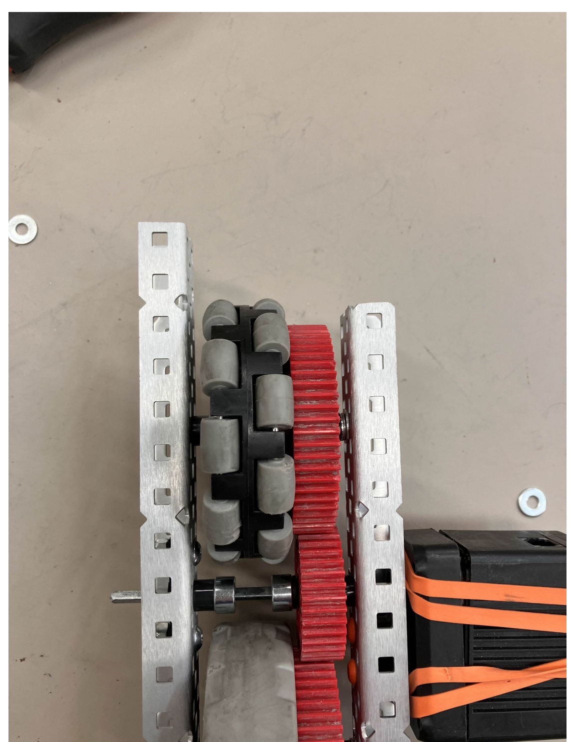
🗒️ Session Summary

During this session, our team built the base drivetrain. The drivetrain as shown in the picture beside this text contained 8 wheel modules, 6 motor caps, and a base frame. (Note that the wheel modules did not have the same amount of spacers as the CAD design) However, the drive's freespin is not up to par so we plan to work on it in the next meeting.

Note: This bracing is not final and there will be many more cross-bars.







Topic: **Building**

Entry by Thom

June 30th, 2024 (cont.)

Date

⚠️ Our drivetrain has high friction

After constructing our drivetrain, we noticed that our freespin was unusually low. This is usually a result of high friction. Possible solutions include preventing metal on metal interactions, using shouldered screws, changing the width of our drive, and adding shaft collars. We will test these solutions in our next meeting. Freespin is a great way to see how well your drive will perform, since a drive with a longer freespin will require less torque from motors to rotate. This would allow the drive to burn out less frequently.

Topic: **Building**

Entry by Reyansh

July 1st, 2024

Date

Building

Meeting Type

⚙️ Meeting Details

Attendance (5/6)

Present: Aden Thom William Dmitry Reyansh
Absent: Traeger

Duration
2 Hours

Location
Quantum Facility

🗒️ Session Summary

During this session, we redid the drivetrain. As we said previously, our drivetrain's freespin was extremely low (around 1s) compared to our goal of at least 5 seconds. We looked at our drive and found a few issues:

- The spacing was incorrect
- There was metal-on-metal contact
- The wheels had little to no wiggle room

These would all cause friction and would therefore reduce freespin. During this session, we figured out these issues and calculated the amount of spacing that there is supposed to be in this drivetrain, as shown on the next page. After that, we disassembled our old drive

Topic: **Building**

Entry by Reyansh

July 1st, 2024

Date

Building

Meeting Type

Dima this is for u, can u write how u found the amount of spacing required in the drive here? Also add some photos :)

THANKSS

Topic: **Building**

Entry by Reyansh

July 2nd, 2024

Date

Building

Meeting Type

⚙️ Meeting Details

Attendance (3/6)

Present: Thom Dmitry Reyansh
Absent: Traeger William Aden

Duration
5 Hours

Location
Quantum Facility

🗒️ Session Summary

During this session we focused on improving the drive and making a prototype mogo mech. We disassembled the left side of the old drivetrain and started putting it back together, properly this time. When we finished building it, we tried testing the freespin. It barely moved. Confused, we watched a video on how to build a proper screw joint: https://www.youtube.com/watch?v=dnlc6CRVUlQ, and realized that we had to either use a shoulder screw or put a bearing on one side of the screw joint. This is because the wheel assembly may be slightly off center. Because of this, the gears will not mesh properly and the drivetrain will barely move.

We then had to disassemble everything. We took all the screw joints off so we could add bearings. We also decided to replace all screws on bearings with zip ties to reduce weight.

Topic: **Building**

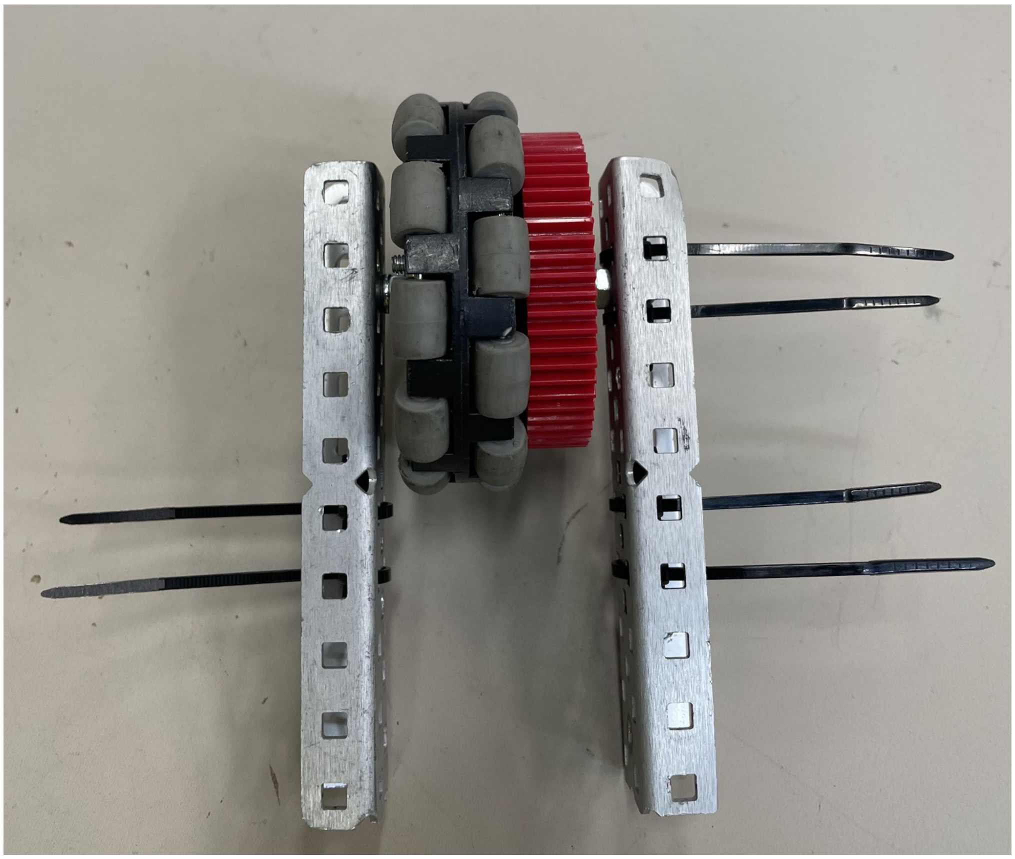
Entry by Reyansh

July 2nd, 2024

Date

Building

Meeting Type



This is an example of a quality screw joint.

Topic: **Building**

Entry by Thom

July 3rd, 2024

Date

Building

Meeting Type

⚙️ Meeting Details

Attendance (3/6)

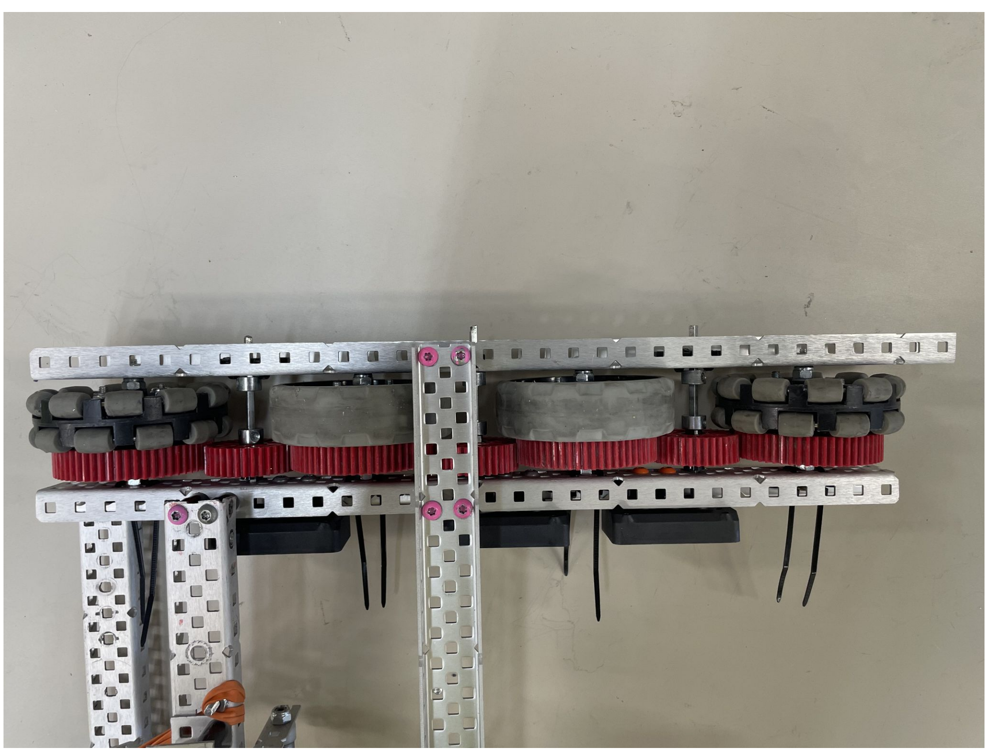
Present: Thom
Absent: Traeger William Aden Reyansh Dmitry

Duration
3 Hours

Location
Quantum Facility

🗒️ Session Summary

Now that the screws had bearings on them, we were able to start re-attaching the wheel assemblies and spacers as we talked about last time, ans we completed the left side of the drive.



Topic: **Building**

Entry by Thom

July 5th, 2024

Date

Building

Meeting Type

⚙️ Meeting Details

Attendance (1/6)

Present: Thom
Absent: Traeger William Aden Reyansh Dmitry

Duration
5 Hours

Location
Quantum Facility

🗒️ Session Summary

During this session we completed redoing the left side of the drivetrain and slightly improved the prototype MOGO mechanism.

Topic: **Building**

Entry by Thom

July 7th, 2024

Date

Building

Meeting Type

⚙️ Meeting Details

Attendance (5/6)

Present: Thom Dmitry Reyansh Aden Traeger
Absent: William

Duration
3 Hours

Location
Quantum Facility

🗒️ Session Summary

Topic: **Designing the Mobile Goal Clamp** *Entry by Dmitriy*

July 7th
Date

Design
Meeting Type

📃 Design: CADding the MOGO clamp

Topic: **Designing the Mobile Goal Ckamp**

Entry by Dmitriy

July 7th

Date

Design

Meeting Type

📃 Design: CADding the MOGO clamp (cont.)