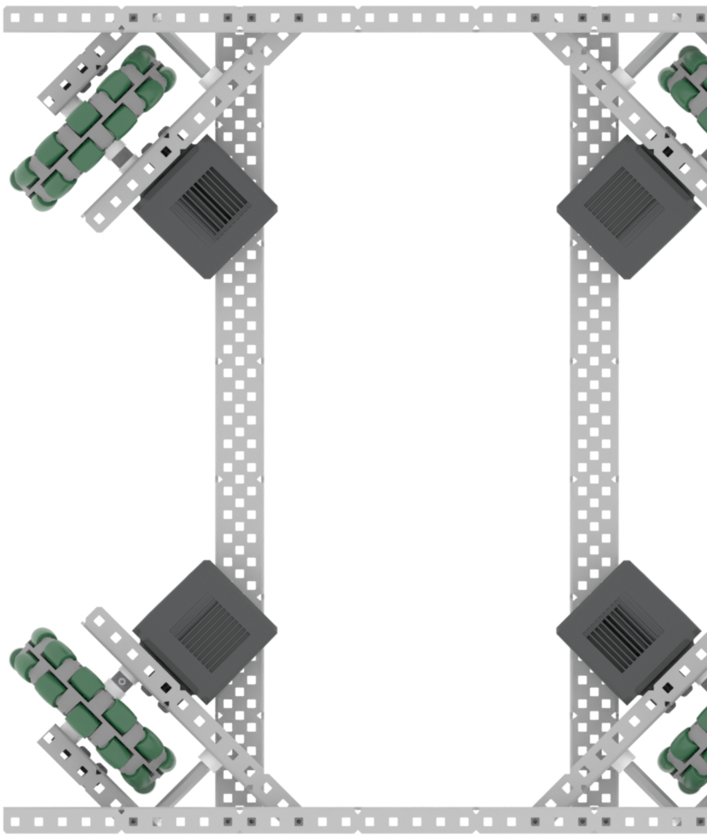
Form Factor

The type of chassis for this year was a major decision for our team. We've wanted to do a X drive for about a year now, but we didn't know if it was ideal for this year's game. If we didn't chose a X drive, we would've used a traditional tank drive (like we did last year).

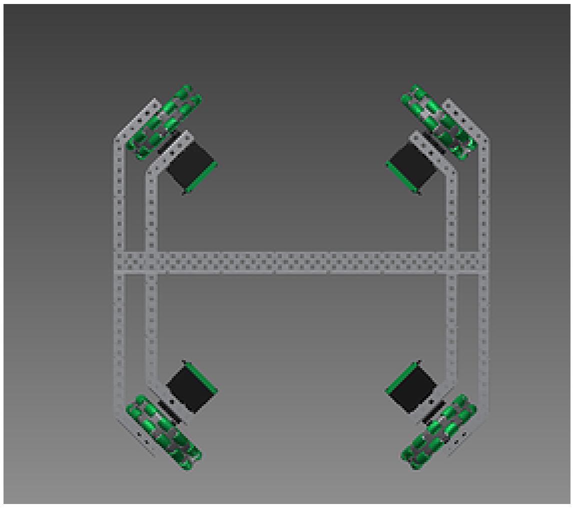
X Drive

Pros:

- A X drive likely will allow us to be more nimble, and have a better offense
- Field Centered Control would be ideal with a robot that has a intake on the front and a launching mechanism on the back
- Ability to strafe is ideal in a game where the field is split into 2
- X drives look cool ##### Cons:
- We can be pushed around more easily and will be prone to defense
- Mounting an intake, launcher, and a endgame mechanism will be difficult with an X drive
- Likely direct drive meaning we have less control over the gear ratio and won't be able to distribute load across motors
- Due to the likely non symmetrical nature of our ideas for endgame, driving straight may be an issue because of center of gravity issues
- Complexity of Code



- Harder to get over the bar ##### Image:



Source: @Codec on vexforum.com ### Tank Drive

Pros:

- Robust and Simple which makes troubleshooting and design easier
- Increased Traction will allow us to be defensive
- Design Flexibility allows us to mount sub assemblies easier
- Simplicity of Code
- Already have experience deciding
- Easier to get over the bar ##### Cons:
- Limited Maneuverability makes efficient operation on the field more difficult
- Larger Footprint
- Limited Aesthetic Appeal (Doesn't look Cool)

**INSERT IMAGE OF LAST YEAR'S DRIVETRAIN

Decision

We ultimately decided to build a X drive because of the competitive advantage that we could gain from being able to be more nimble on the field. I predict that this year's meta will be a lot less focused on brute force and more on agility because the tasks require you to move quickly and efficiently within a small space compared to last year. Right now it seems like each match will have an "Over" bot and an "Under" bot that stay on their respective side and either toss over tri-balls or push them under the goal. This means that you don't need to cover very much ground throughout

Right now, we have no expirence with holonomic drives or CAD, so we decided it would be a good idea to learn both at once. The first decision that we had to make is what CAD software to use. We have access to all Autodesk products through their education license, so we have lots of choices. Based on vex library compatibility, we have the option to use Inventor or Fusion 360. My OS of choice is MacOS, and Inventor doesn't have Mac support. Because I'll probably be the main CAD designer, that makes the decision easy.

Learning Fusion 360

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Math We need to make sure that the holes on the inner and outer tracks are aligned so we can fit an axle through it at the ends. This actually is more difficult then it sounds, because it won't just naturally lineup. Both the size of standoffs between the tracks and the length of the different parts impact if the holes will lineup.

To ensure that the inner and outer tracks of the chassis design align at the angled ends, we can set up a relationship based on the given parameters.
Defining Variables:

Let L_i be the length of the inner track's central c chanel. Let L_o be the length of the outer track's central c chanel. Let θ be the angle at which the tracks are angled relative to a horizontal axis Let d be the distance between the inner and outer track at the base (the length of standoff).

Relationships: The height change due to the angle for both the inner and outer tracks can be found using trigonometry.

Inner Track:

$$\Delta h_i = L_i \times \sin(\theta)$$

Outer Track:

$$\Delta h_o = L_o \times \sin(\theta)$$

Alignment Condition: For the tracks to align at the angled ends, the height difference due to the length and the height difference due to the angle must be equal:

$$\Delta h_o - \Delta h_i = d$$

This gives:

$$\sin(\theta) \times (L_o - L_i) = d$$

If we set theta at 45 degrees (gussets we plan to use), the above relationship becomes:

$$\Delta h_i = L_i \times \frac{\sqrt{2}}{2}$$

$$\Delta h_o = L_o \times \frac{\sqrt{2}}{2}$$

Substitute in the height changes:

$$\frac{\sqrt{2}}{2} \times (L_o - L_i) = d$$

Thus, the distance d is given by:

$$d = \frac{\sqrt{2}}{2} \times (L_o - L_i)$$

This equation provides the relationship between the lengths of the inner and outer tracks' central metal pieces L_i and L_o and the distance d for the tracks to align at a 45-degree angle.

Game Release Thoughts

Game Release Thoughts + Finding The Meta

2 - Deciding on The Chasis

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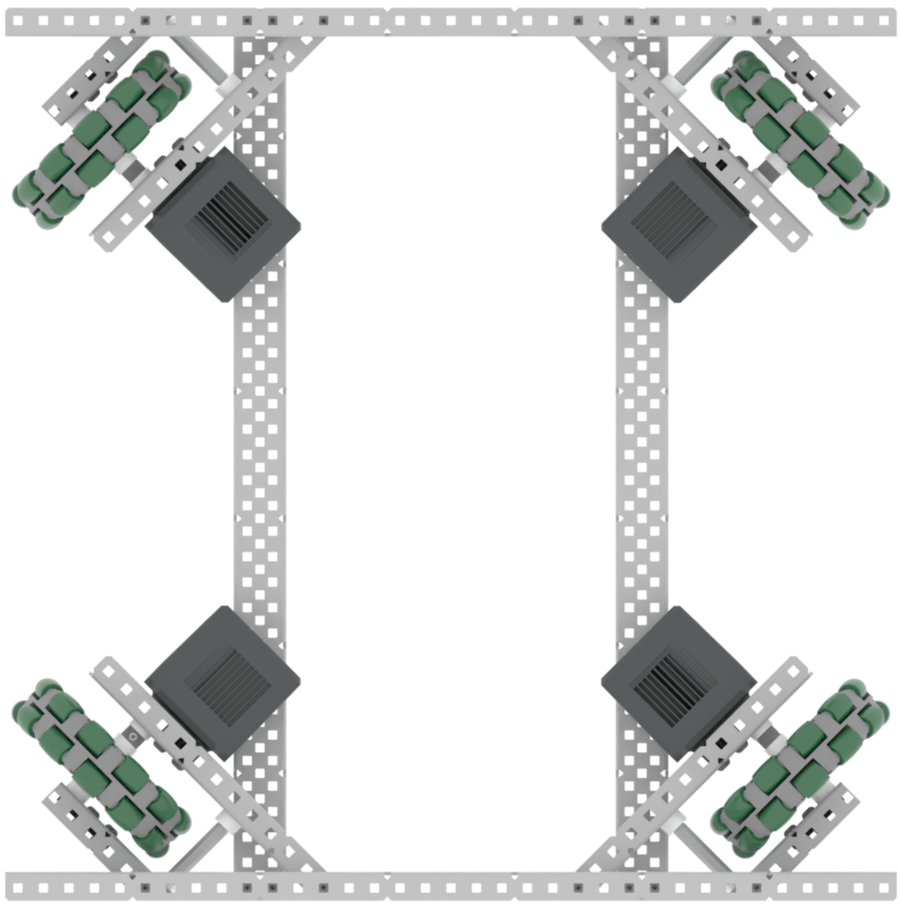

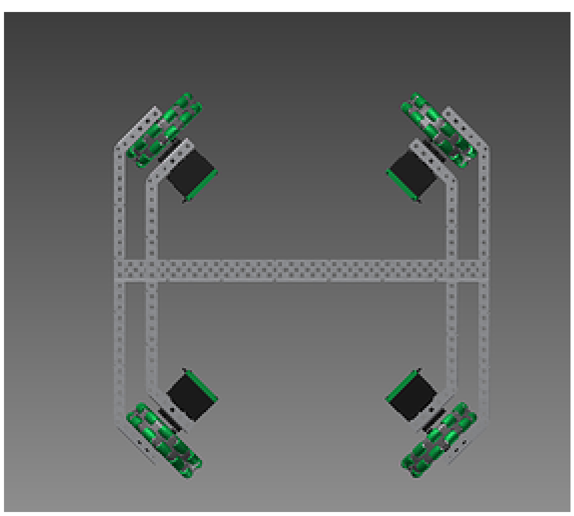

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Designing a X Drive

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Substitute in the height changes:

$$1 \times (L_o - L_i) = \Delta h$$

Thus, the distance d is given by:

$$\Delta h = 1 \times (L_o - L_i)$$

This equation provides the relationship between the lengths of the inner and outer tracks' central metal pieces L_i and L_o and the distance d for the tracks to align at a 45-degree angle.

Applying The Math We know that we want to have our Total Length as close to 18in as possible. Here are some values that will accommodate that. $L_i = 8in$ $L_o = 11in$

With that in mind, we can find the correct distance of standoff, d

$$d = (L_o - L_i)$$

$$\Delta h = 11 - 8$$

$$\Delta h = 3$$

$$d = 1.5$$

Considering the constraints of the Vex Design System, the best option is going to be $2in$ standoffs, and we can accommodate for the error by aligning the holes using the give in the screws we use for the gussets. ## Cadded Design After figuring out the optimal dimensions, we created different sub assemblies. First, I created a inner and outer track

Inner Track

[[Iteration_1_2023-Oct-17_01-26-37PM-000_CustomizedView14535115016_jpg.jpeg]] ### Outer Track

[[X-Drive-Bar_(Large)_2023-Oct-17_01-27-08PM-000_CustomizedView385919524_jpg.jpeg]] And then connected them into a side assembly. ### Side Assembly [[X-Drive-Side-Assembely_2023-Oct-16_11-46-25PM-000_CustomizedView13816525200_jpg.jpeg]][[X-Drive-Side-Assembely_2023-Oct-16_09-45-49PM-000_CustomizedView6898571831_jpg.jpeg]] ### Assembly After creating the side assemblies, I brought them into a final assembly and mirrored them. Then I added Motors, Wheels and structural Supports. Because being lightweight is very important this year, the only steel parts are the central braces. The rest is made up of aluminum. The reason that we used steel for the central parts is to reduce flex between the two sides. [[X-Drive-Assembely_2023-Oct-17_01-29-51PM-000_CustomizedView15178685553_jpg.jpeg]] Here is the assembly with the Tri-Ball next to it. This puts it into perspective about how large the Tri-Ball actually is. [[X-Drive-Assembely_2023-Oct-17_02-59-42PM-000_CustomizedView13390833218_jpg.jpeg]]