It team’s first brainstorm on chassis design resulted in two big ideas, **to use treads or to use wheels**. We also realized that a low center of gravity is important to climb the mountain effectively. Our building team split into two groups, one to work on the wheel evolution, and one to work on the treads.

Wheel progression:

In order to climb the mountain, we needed **fairly large wheels in order to not fall** between the churros. We did research and ordered 6” AndyMark wheels that were large enough to bridge the churros. We built a chassis with these and found that they **did not have enough traction** to make it up the low mountain zone. To fix this we replaced the tire material with a **grippier surface,** however the wheels were **still unable** to go up the churros. We then designed **spiked wheels that would grip the churros** and pull the robot up the ramp, these worked well, but were unable to climb the high zone. At this point, we decided that wheels were not the most efficient solution, and we **pivoted to focus on tread development only.**

Tread progression:

Our club had never used treads before, so when we started we did not know where to begin. One group **began working with the standard tetrix treads**, while another researched other FTC tread options. We found that tetrix treads did not have enough traction on their own, so we inserted rubber grips into the treads. This allowed us to get up the low zone, however we couldn’t go any further. We then experimented with paddles and other profiles on the treads. These worked well, however they would often get caught because of the rigidity. We had many issues with some materials being too stiff, while others too loose. **We then found NinjaFlex, which is a flexible rubber that can be 3D printed with.** This allowed us to control the flexibility within our CAD models. We used CAD to find the ideal flexibility and then 3D printed profiles to mount on the tetrix treads. We could then climb all the way to the high zone.

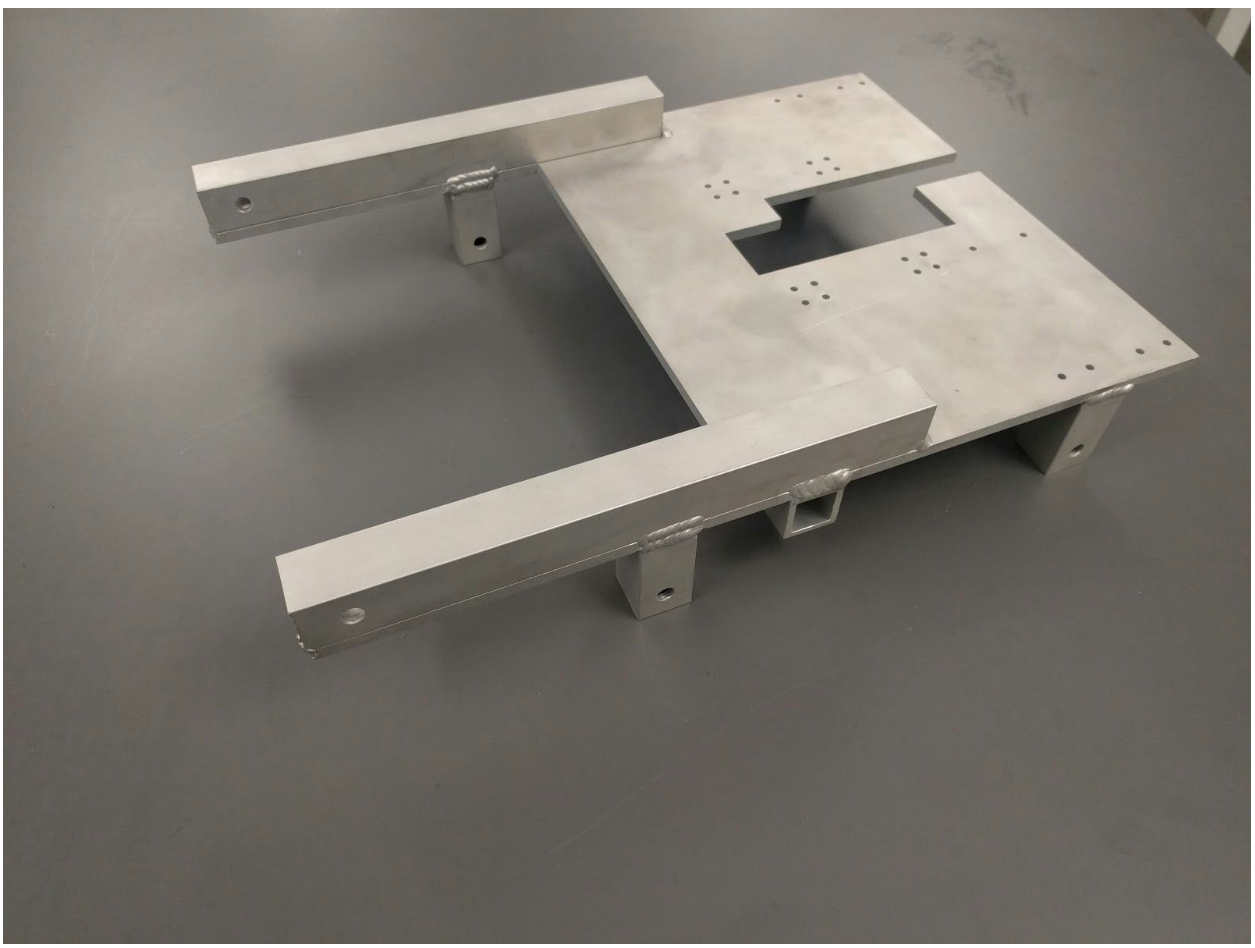
After further testing, we found that tetrix treads would break very often because the plastic would flex and disconnect from the other treads. To fix this, we drilled out the tetrix and reinforced it with bolts to make it stronger. We then had issues with the plastic of the tread cracking and breaking under normal loads, so we realized that **tetrix treads were not a viable option**we simply because they were too weak for the demands of a competition.

We then went to our research on other tread options. We had found another team that used a timing belt from a company named BrecoFlex. We ordered samples from them in order to determine which would be the best belting material. We also found Lynx Motion, a company that sold tetrix like treads, but they were much stronger and came with a grippy material pre-attached. We ordered these instead of the breco flex because they would be easier to mount on the robot, and we believed that they would be just as effective, in addition to having less points of failure.

The Lynx Motion treads were very easy to switch out for tetrix, as they were extremely similar in design. These were easily able to get up the mid zone with no profiles, and once we zip tied the ninjaflex profiles to it, it easily climbed the high zone, it also did not break like the tetrix did. We found that the zip ties would increase the friction of the treads, and the motors would strain. We fixed this by taking the usual mount, a teflon pin, and drilling a hole through it. The zip tie would pass through the teflon and provide a sturdy, low friction mount. We also switched out the 3D printed ninjaflex for a stronger plastic and rubber piece for damage insurance. This new drive train climbs the mountain extremely quickly and easily. We decided to use these treads on out final robot, as they were durable and effective.

Chassis Body:

For our first competitions we used a very basic tetrix frame, because this is what we were prototyping with, and it worked relatively well. We realized that this would not be a good long term plan, so we turned to our partnership with PACFAB. Samin CADed a chassis that would be waterjet and welded, which we sent to Pacfab. They made the basic frame for us, and then sent it back.



After interleague competition, we bega transferring mechanisms over to our new waterjet chassis. We also added two new mechanisms, the block collector and scorer. There were a few issues we did no foresee, such as the treads contacting certain areas of the chassis. These were fairly easy to fix with an angle grinder and our mill. There was also a very large amount of work done on wiring to make it clean and easy to service. This was our biggest challenge on our new chassis, because during out design we left wiring for last. We eventually found solutions for it and made a clean reliable robot.

Onto Super Regionals:

At State our team had crippling static issues, which prevented us from driving. To fix this, we spoke with a **retired electrical engineer** who gave us a presentation on the causes and solutions to static discharge issues. We used a combination of **coding solutions, static wipers, and tread re-design to reduce static issues**. These helped, but we still had disconnection issues.We tried using **anti-static spray and fabric softener** to coat the threads. This worked extremely well, and we no longer had static discharge issues.

The next big problem we faced was that our robot would **drain batteries extremely fast**, so quickly that we weren't able to finish entire matches. After **using a battery logger** we designed to measure the draw, we found the main draw source was our **robot's drive train**. What we did to solve this was experiment with **different drive train** set-ups. We tried using **wheels** in the back and treads in the front, this reduced the draw, but **didn't climb the ramp** well. We experimented with many different **wheel materials and profiles, but none of them were effective.** The next step for our chassis was to reduce the amount of force required to turn the treads. We solved this by driving **2 sprockets instead of just 1 sprocket**. This allowed us to **decrease the tension** and therefore the current draw. After solving this issue, there were no more issues for our chassis, and we were free to work on drive practice and autonomous.