

# E.V.E.

An Ultimate Frisbee Playing Robot

FIRST Team 3504

The Girls Of Steel

Mentored by Carnegie Mellon University  
Field Robotics Center

By: Lynn Urbina,  
a member of Team 3504

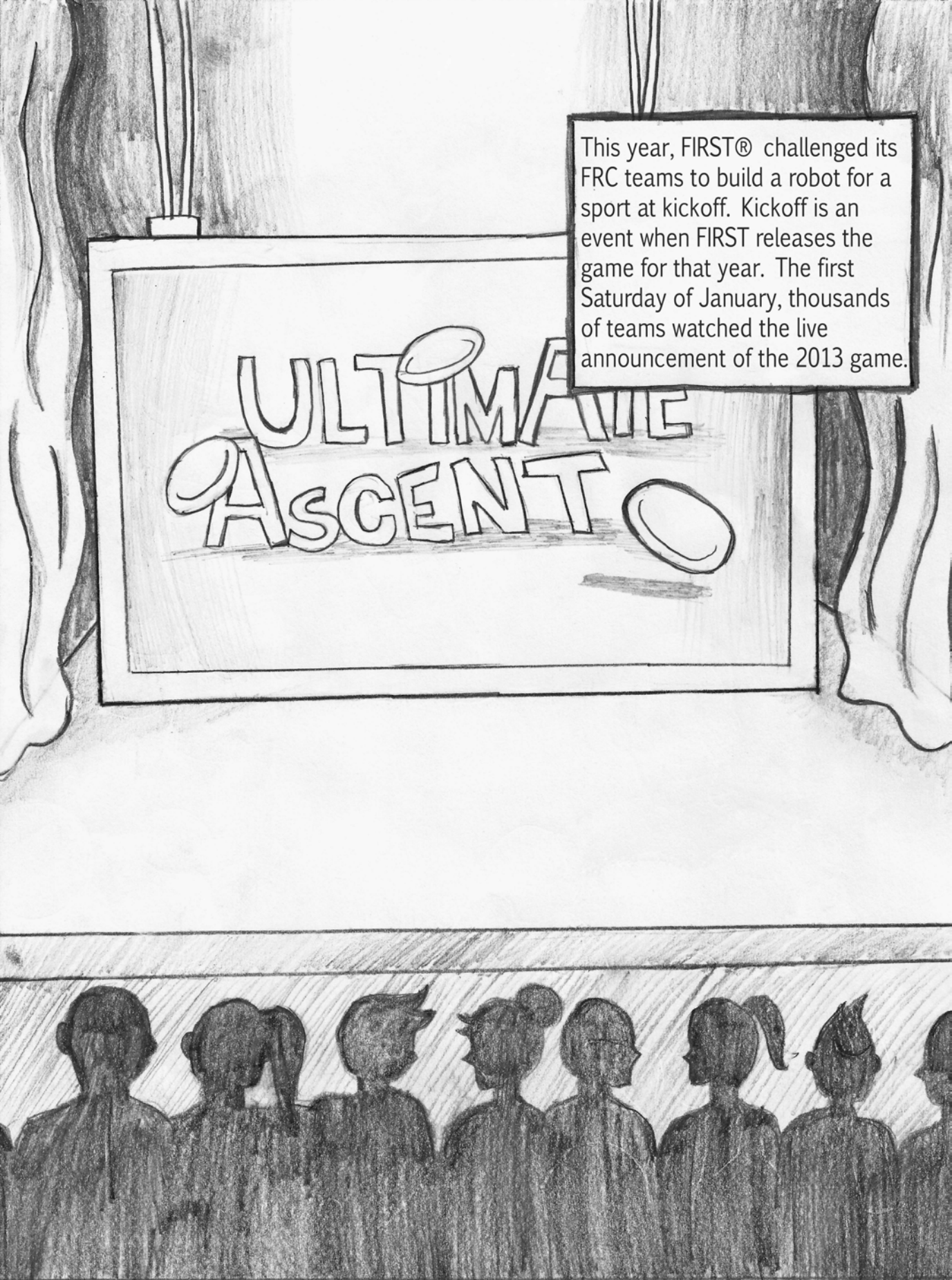
Team Osaka's  
VISON NEXTA



Robots can be made to do many things. Sometimes they can be made to help build cars and automation, but robots can also be made to play sports! Robots have been created to play a variety of sports like soccer, ping pong, basketball and air hockey.

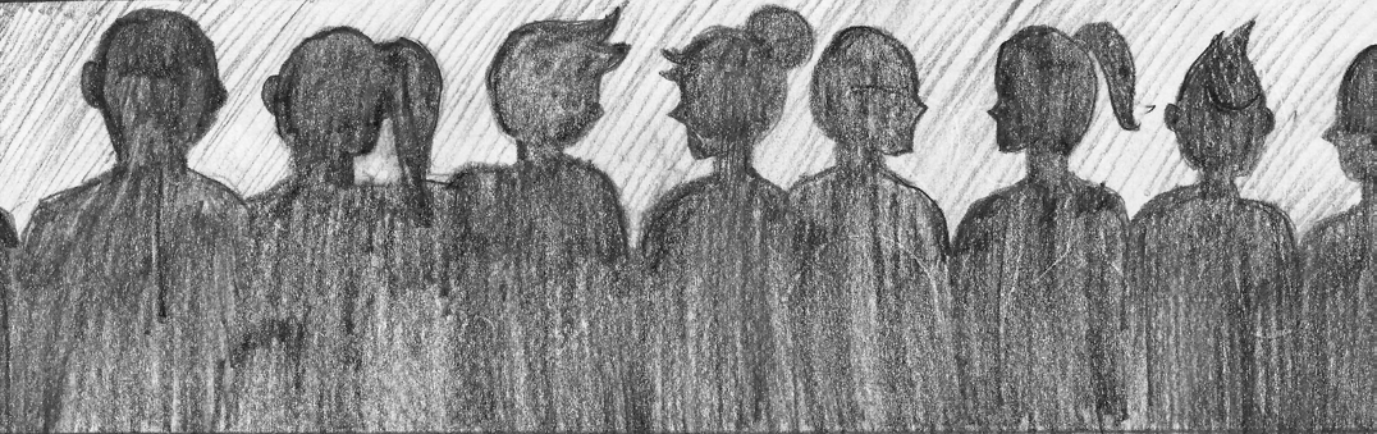
TOSY's TOPIO:  
a Ping Pong  
playing robot

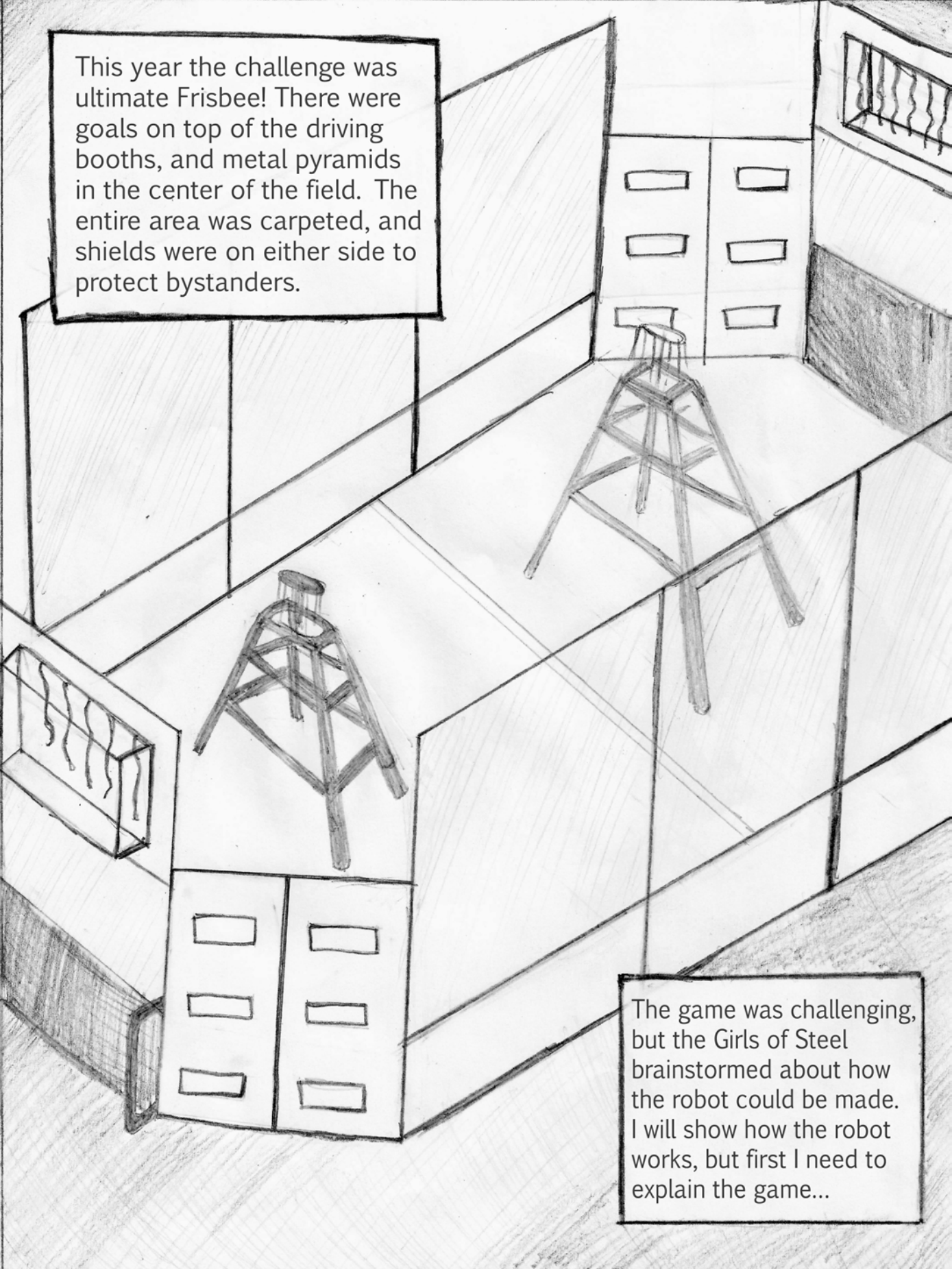


A hand-drawn illustration in black and white. At the top, a large rectangular sign is mounted on a wall, flanked by curtains. The sign contains the text 'ULTIMATE ASCENT' in a stylized, bubbly font. To the right of the sign, a text box contains a paragraph of text. Below the sign, a horizontal line separates the stage from an audience. The audience is depicted as a row of dark, stylized silhouettes of people's heads and shoulders, facing the stage.

This year, FIRST® challenged its FRC teams to build a robot for a sport at kickoff. Kickoff is an event when FIRST releases the game for that year. The first Saturday of January, thousands of teams watched the live announcement of the 2013 game.

# ULTIMATE ASCENT

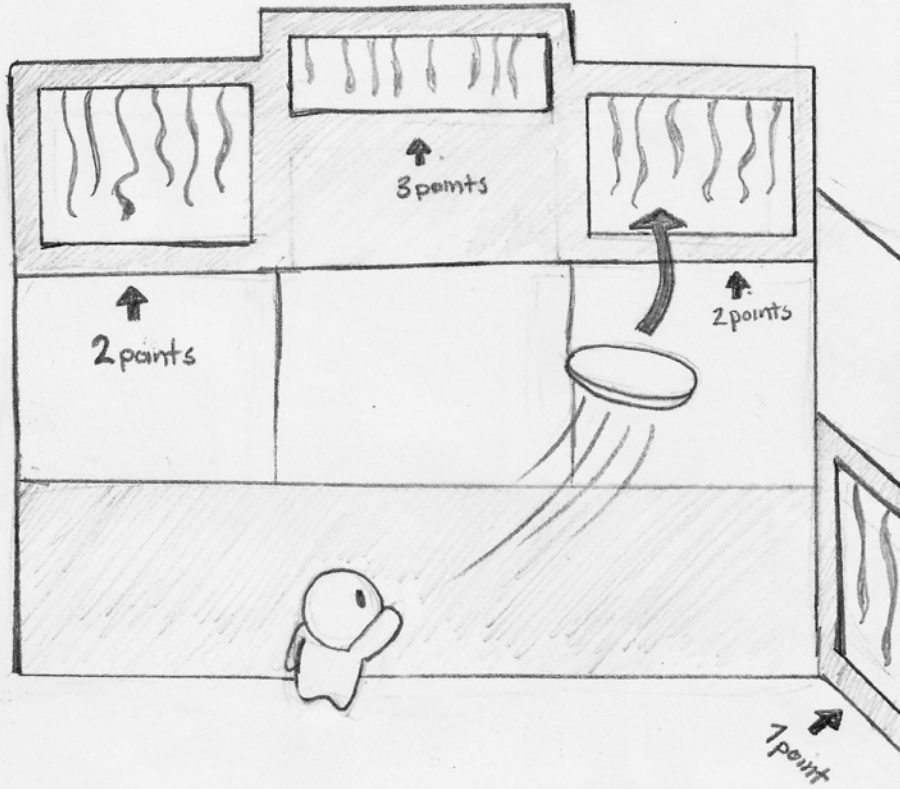




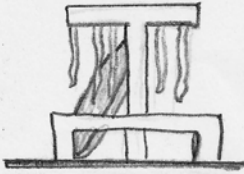
This year the challenge was ultimate Frisbee! There were goals on top of the driving booths, and metal pyramids in the center of the field. The entire area was carpeted, and shields were on either side to protect bystanders.

The game was challenging, but the Girls of Steel brainstormed about how the robot could be made. I will show how the robot works, but first I need to explain the game...

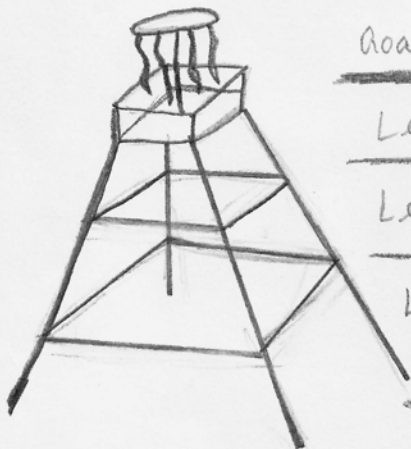
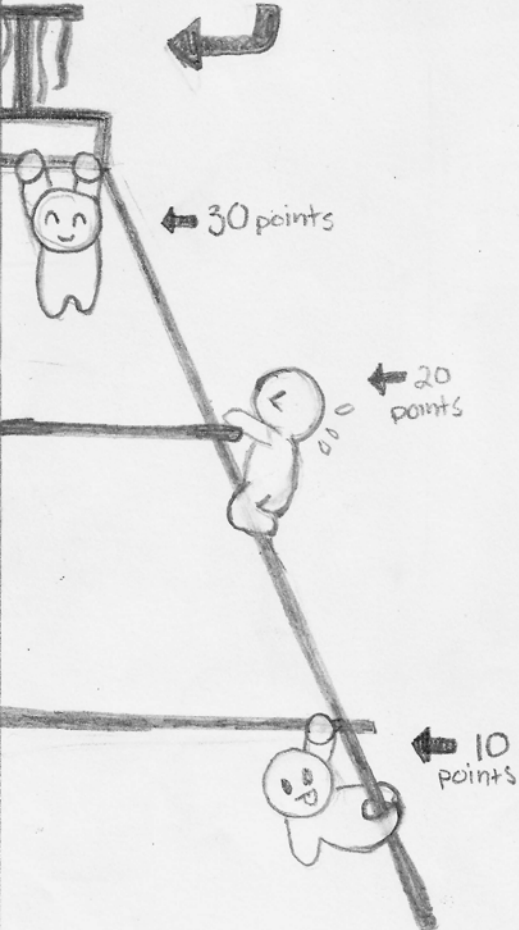
There are a total of five goals for each side. They are worth 1, 2, 3 and 5 points, depending on which one the Frisbee gets in.



The goal that is worth 5 points is on top of the pyramid. Only red or blue Frisbees shot into this goal get 5 points.



The pyramid is the most interesting part of the game. In the last 30 seconds, robots could climb the rungs of the metal pyramid to get points. The robot had to be off the floor in order to earn points. Getting on the first rung is worth 10 points, the second rung is worth 20, and the top rung is worth 30 points.



- Goal

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- Level 3

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- Level 2

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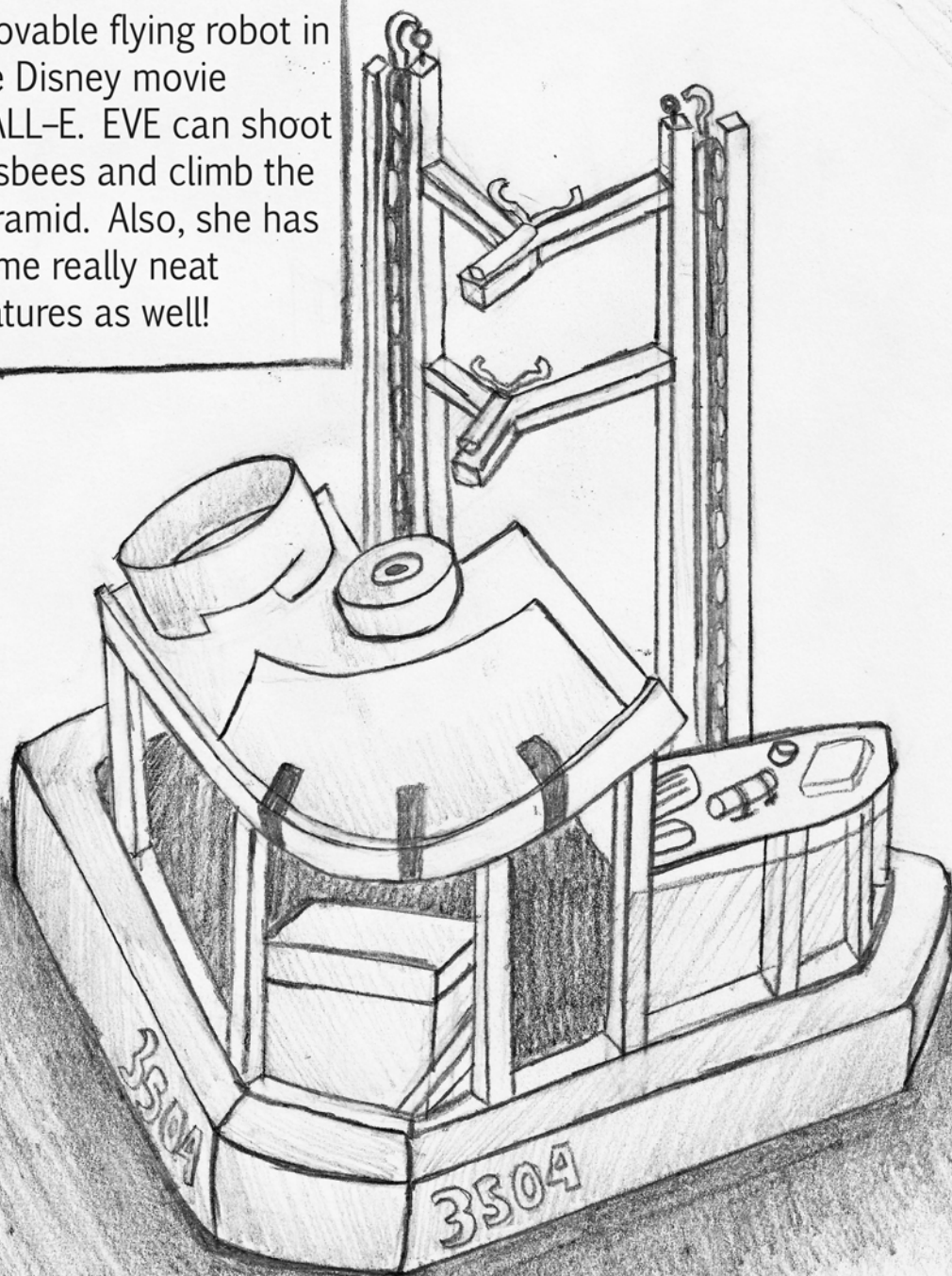
- Level 1

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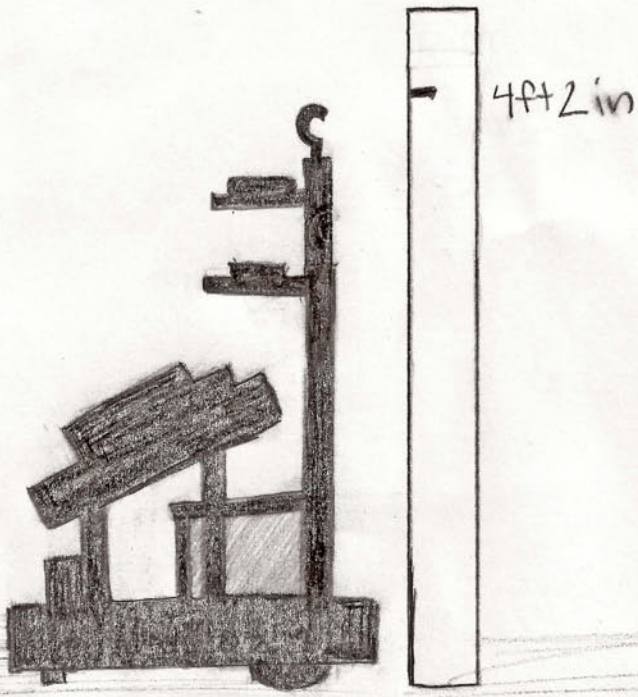
What's this squiggle?  
 My attempt to draw a chain  
 What chain looks like:



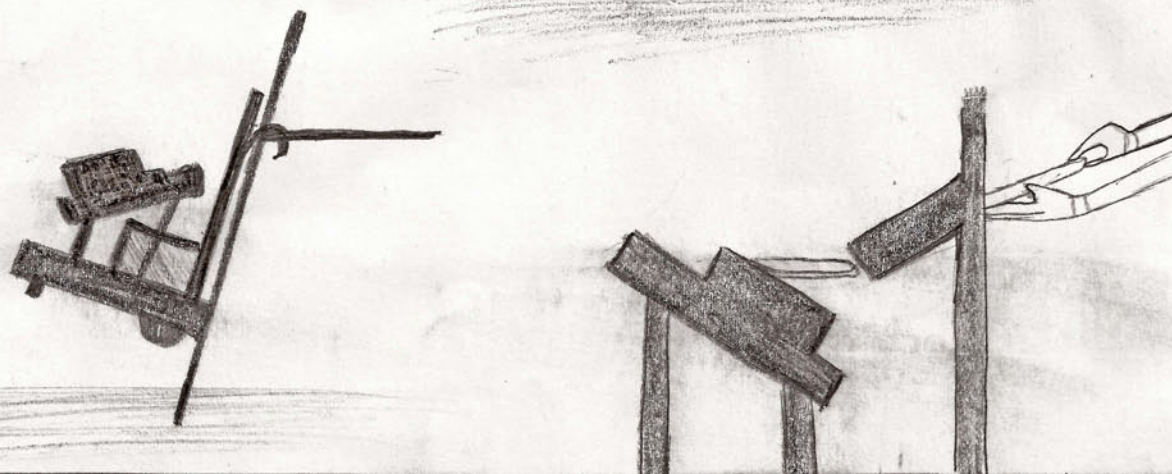
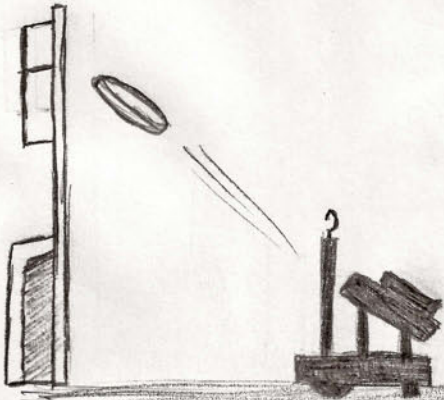
Our robot EVE can do it all! We named her after a lovable flying robot in the Disney movie WALL-E. EVE can shoot Frisbees and climb the pyramid. Also, she has some really neat features as well!



EVE stands about 4 ft 2 inches tall (1.3 meters). She is a small robot, in fact I am taller than her!

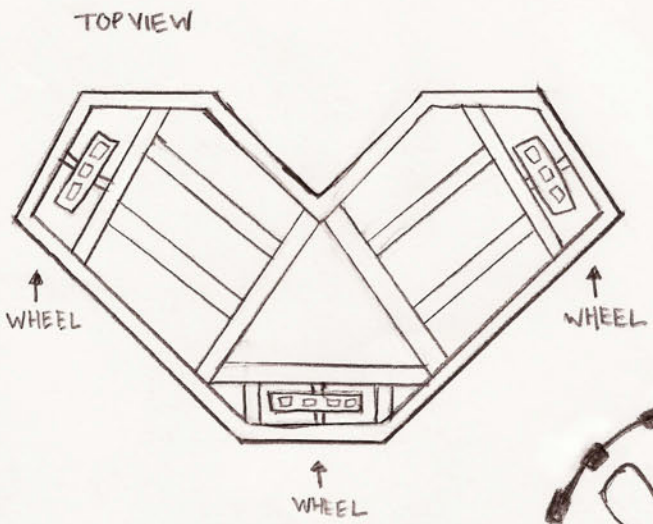


EVE can do everything in the game. She can climb, shoot Frisbees and receive Frisbees. I'll explain how she is able to do it all! Let's begin with a fundamental part of a robot...

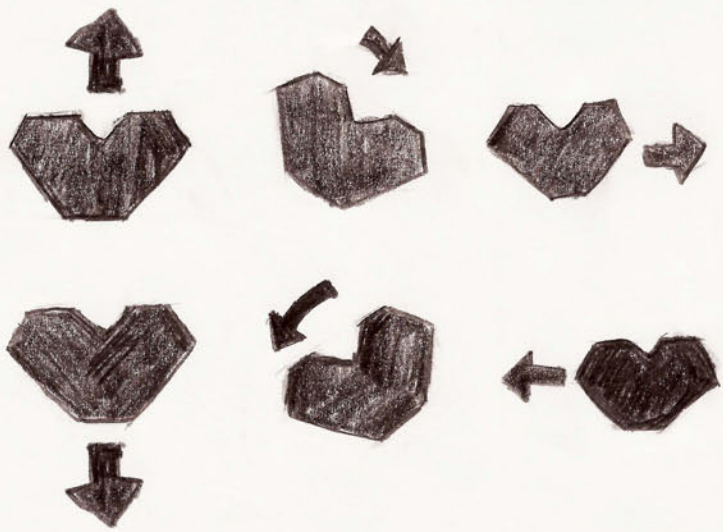
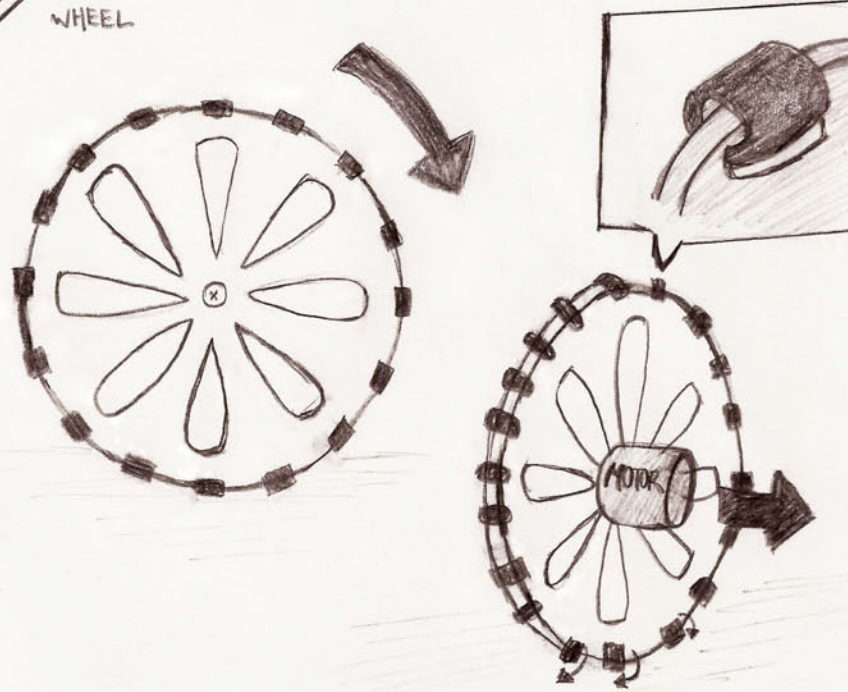


# THE CHASSIS

The chassis is the base of the robot that allows it to move around. EVE's chassis is in the shape of a heart, which allows for some really cool features to be added. Instead of having four wheels, this chassis only needs three! The wheels aren't the same as normal wheels; they are much more unique.



The wheels are actually a combination of a few things. Along the edge of the wheel, there are smaller wheels perpendicular to the edges that are not attached to a motor. The wheels also turn with a motor which moves the chassis.



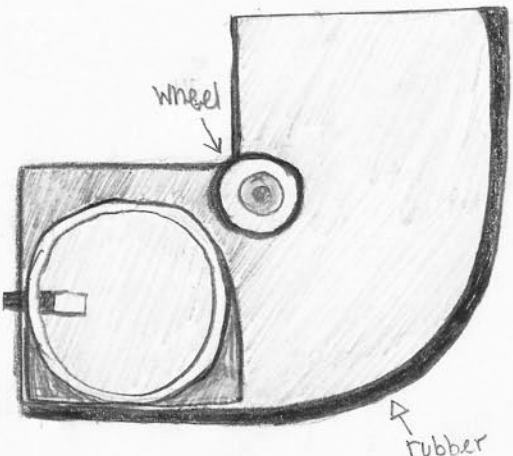
The tiny wheels allow the wheels to be dragged without any resistance. Because of this and the position of the three wheels, the chassis has two additional ways of movement. The chassis can move the standard forward, backward, turn left and turn right, and it can also drift left and drift right.



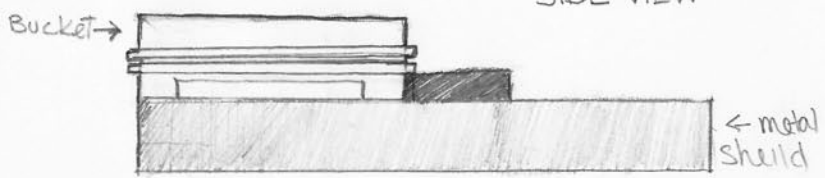
# THE SHOOTER

The shooter was designed so that Frisbees could be launched at the 3 point goal. There are four important pieces to the shooter. is a bottom sheet, a curved guard lines with rubber to prevent slipping, a wheel and the feeder. The feeder is made from a bucket with metal wings to help guide the Frisbee.

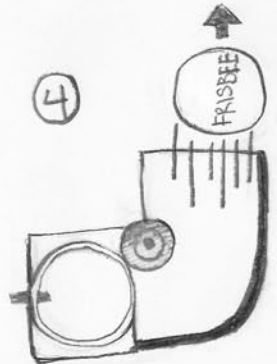
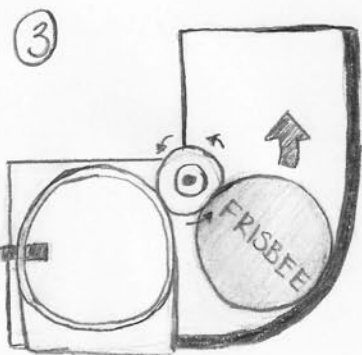
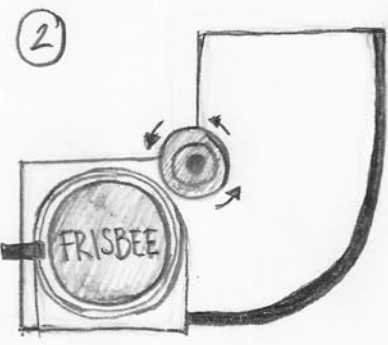
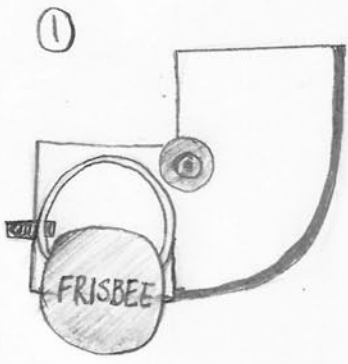
TOP VIEW



SIDE VIEW



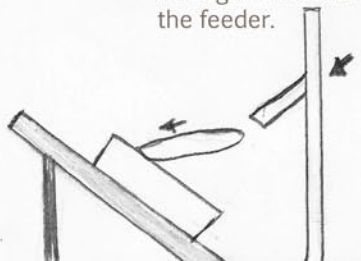
To shoot Frisbees, the Frisbees are loaded into the feeder. The wheel starts to spin then the Frisbees are pushed with a piston into the curved area. The pressure between the wheel and side guard cause the Frisbee to be launched into the air out of the shooter.



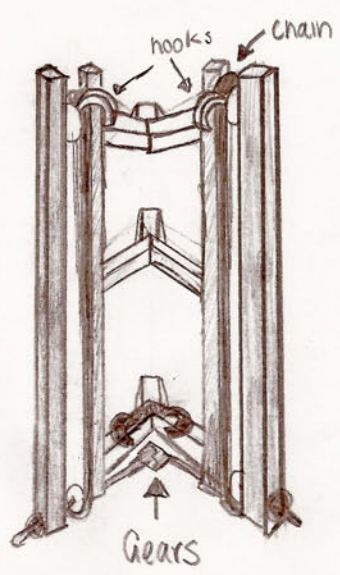
How do the Frisbees get into the feeder?



The feeding station allows humans to send Frisbees through a slot into the feeder.



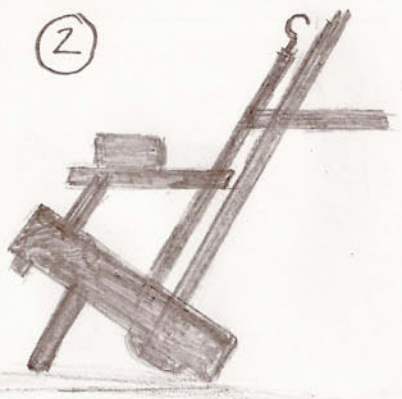
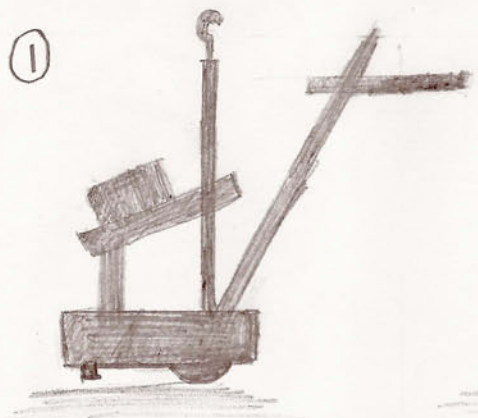
# THE CLIMBER



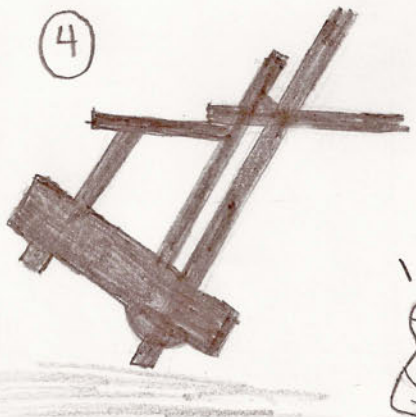
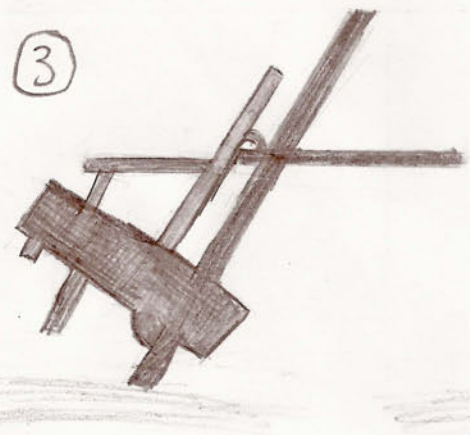
That's a lot of chain!

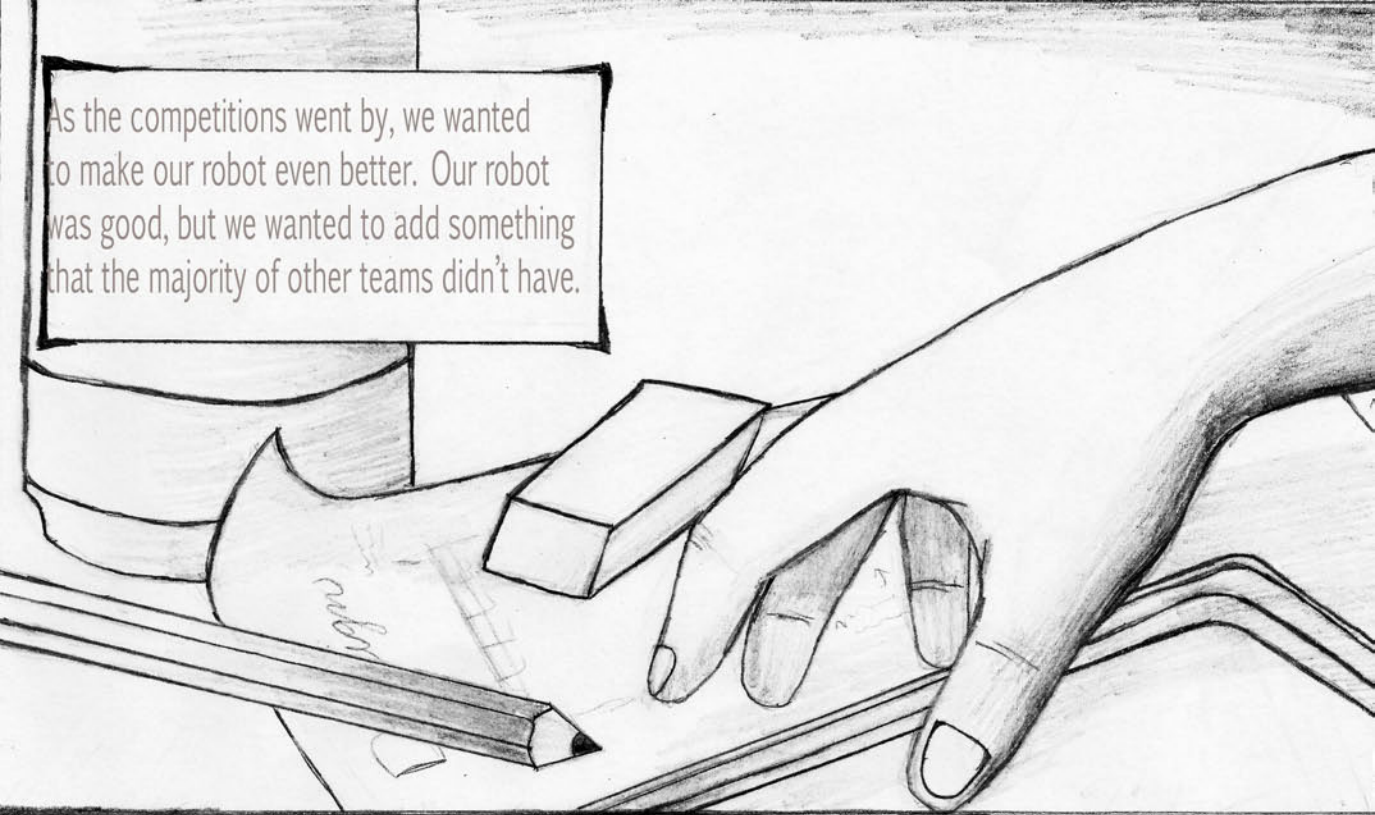


The climber is made to lift onto the first level of the pyramid. It has two chains with identical claws on the same level with each other. Both chains are connected to the same moving gear at the bottom of the climber. There is also a gripper at the bottom of the entire system.




To start climbing, the robot first lines up to one of the corners of the pyramid. Then, with a piston powered foot, the robot leans at the same angle the pyramid is. Then the chain starts to move, pulling the claws down onto the first level rung. It pulls the robot off the ground, and the piston foot is lifted.



A black and white illustration of a hand holding a pencil over a drawing board. The drawing board has a ruler and a pencil. The hand is positioned as if about to draw or write. The drawing board has some faint lines and a ruler. The pencil is held in a tripod grip.

As the competitions went by, we wanted to make our robot even better. Our robot was good, but we wanted to add something that the majority of other teams didn't have.

A black and white illustration of a person's face, wearing safety goggles. The person has long hair and is looking directly at the viewer. The goggles have circular lenses and a strap. The person's expression is neutral.

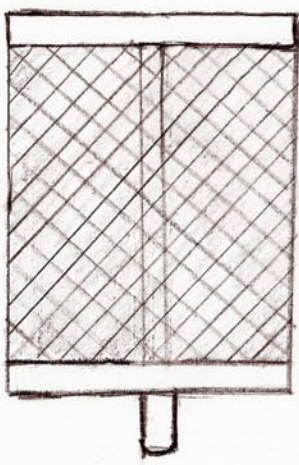
We went back to the drawing board. We designed, built and tested our new part. Even though it was the middle of competition season, we still wanted to put in one last part onto our robot. We decided to make...



We made a blocker.

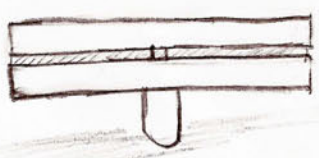


# THE BLOCKER

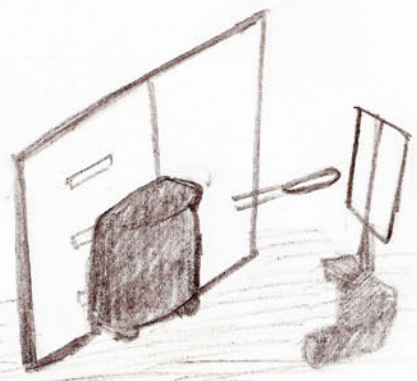
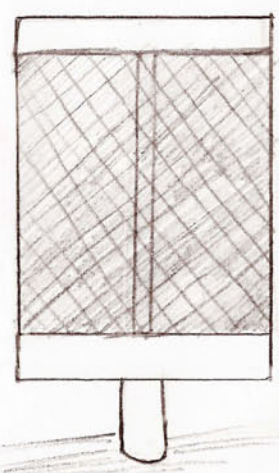


The blocker is controlled with a piston that raises and lowers the blocker. In between the top and bottom rung, there is netting that is attached with a string to prevent Frisbees from being scored.

①



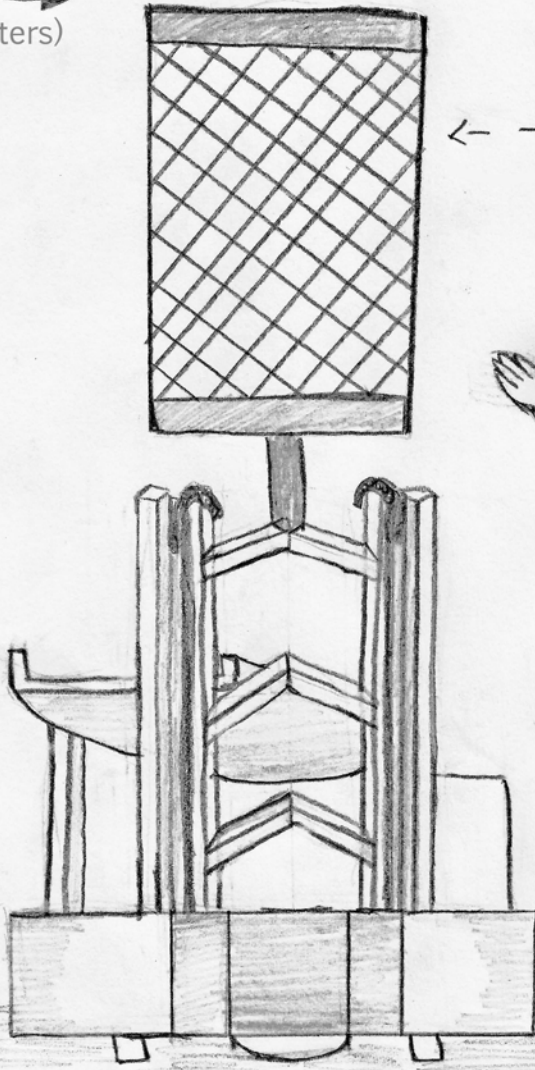
②



Like a ninja!



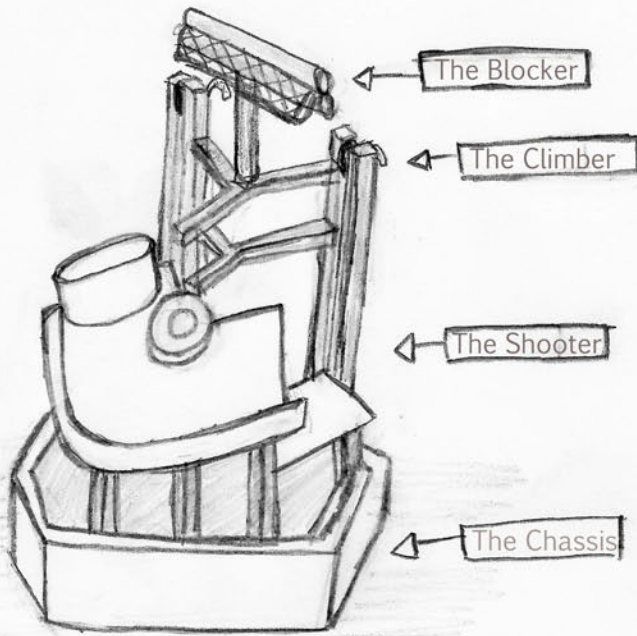
5 ft 8 in →  
(1.73 meters)



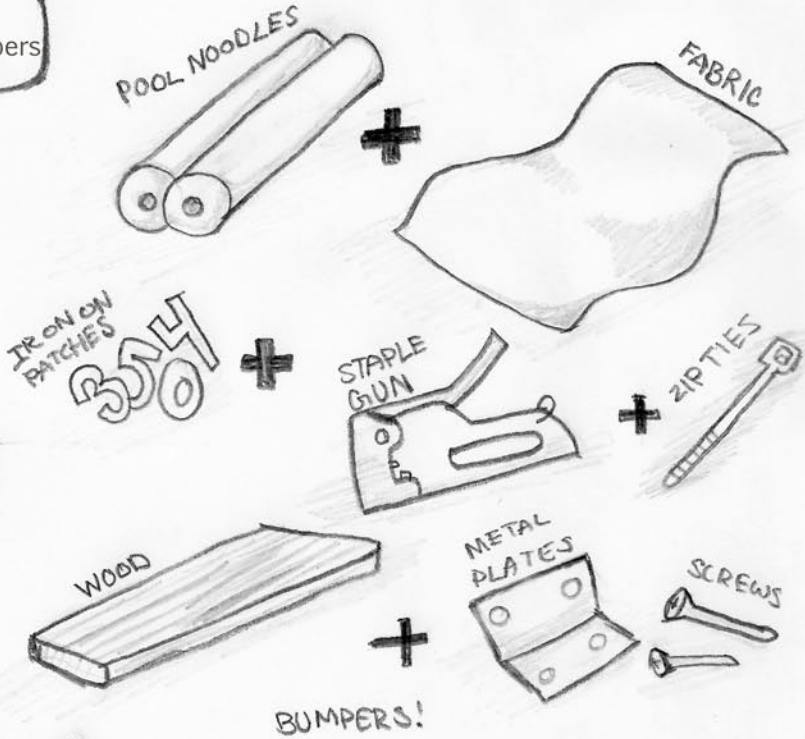
With the blocker, the robot stands over 5 ft 5 in! The extra height of the blocker makes it easier to block Frisbees. It also happens to make EVE taller than many of the girls on the team.



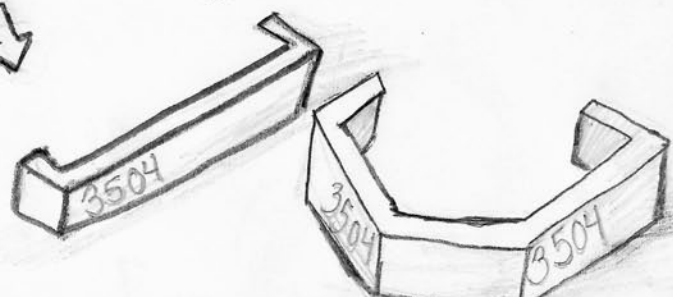
This is not fair...



EVE requires each part to perform at her best! EVE also has programming and electronics. Those components are a big part of building robot. Programming the chassis was a new challenge for the programming girls. This is also the first time we added pneumatics (air powered mechanisms) which was a new for the electronic girls.



Bumpers are made to protect the chassis from getting ruined during matches. It is made of wood that is cut so it covers the outside of the chassis. It is put together with metal plates that are screwed into place. Foam pool noodles are attracted to the wood with zip ties and then covered with a fabric. The team number is then placed onto the fabric. There are pins (a metal rod with a ring on the top) that secure the bumpers by going through the holes in the chassis.



The robot is controlled by two controllers; one is a joystick while the other is a PS2 controller. Controlling EVE is so much fun! The chassis is especially awesome because it has a gyro. In gyro mode, the chassis will go forward when the joystick is forward, no matter what orientation it is in!

CONTROLLER 1  
Controls Chassis

CONTROLLER 2  
controls shooter  
tips over robot  
controls the climber  
controls the blocker



CONTROLLER 1

CONTROLLER 2



This joystick is cool because it can twist. The joystick can use all six ways of travel.



I hope you liked learning about EVE!  
If you would like to learn more about  
The Girls of Steel and EVE, check  
out our website at:  
[girlsofsteelrobotics.com](http://girlsofsteelrobotics.com). Thank you  
for reading, and never stop learning!

Comic made by:  
Lynn Urbina, a 3504  
Girls of Steel member

