WAUNAKEE
COMMUNITY SCHOOL DISTRICT

Atomic Smash

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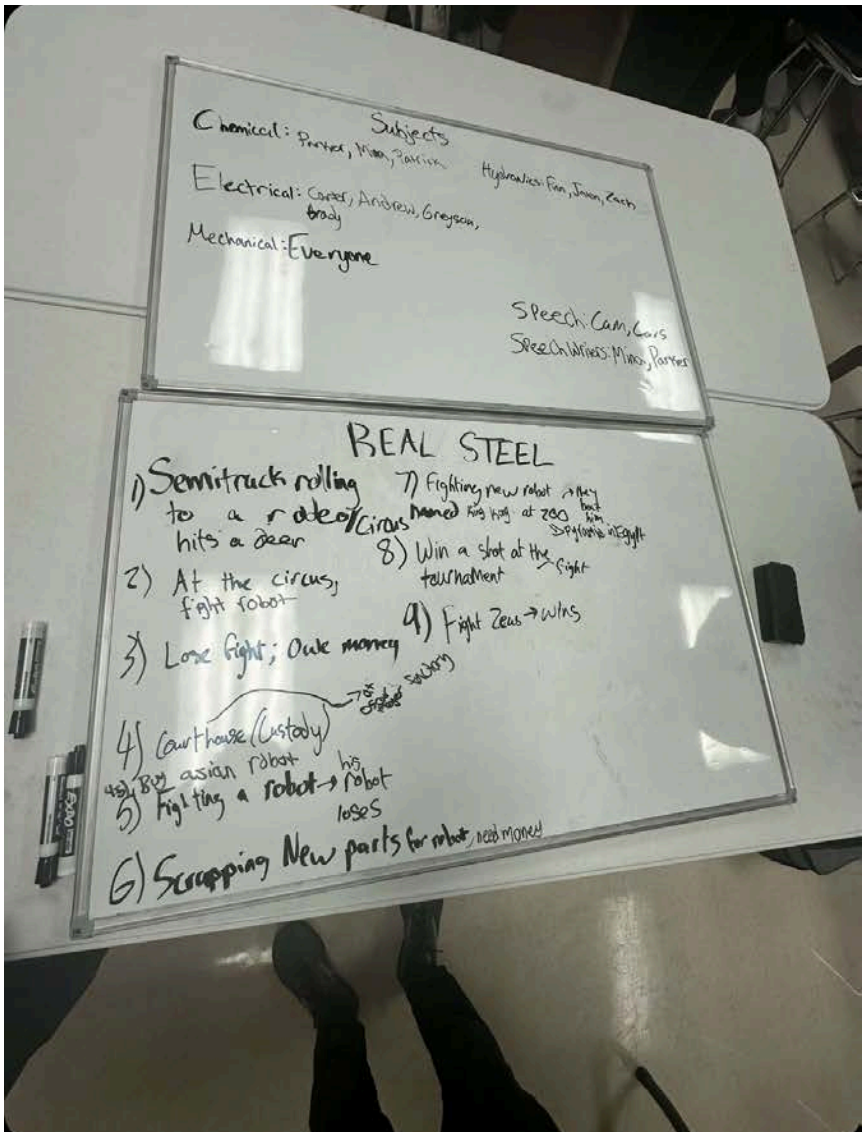
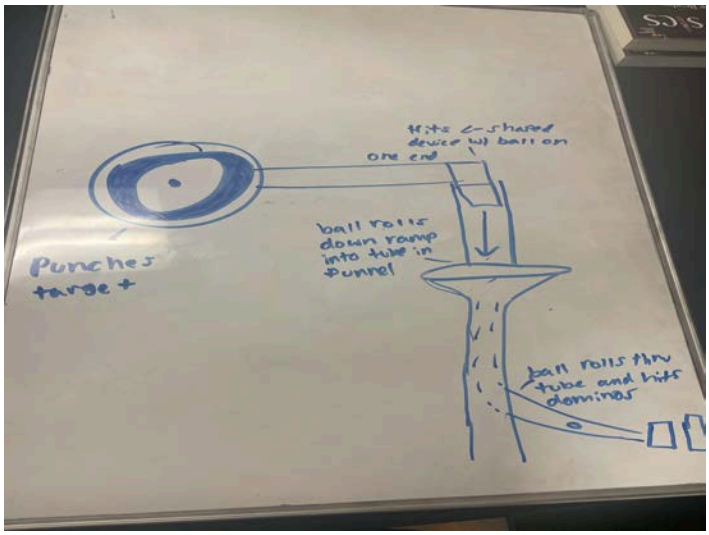
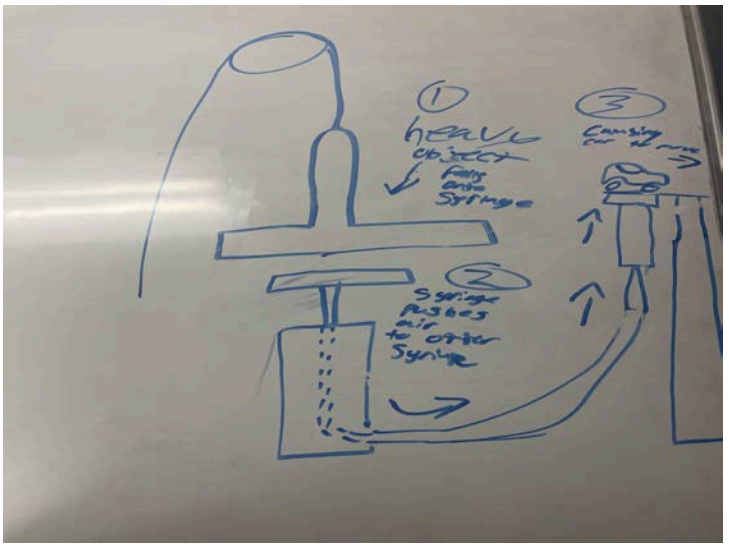
Table of Contents

Progress Photos

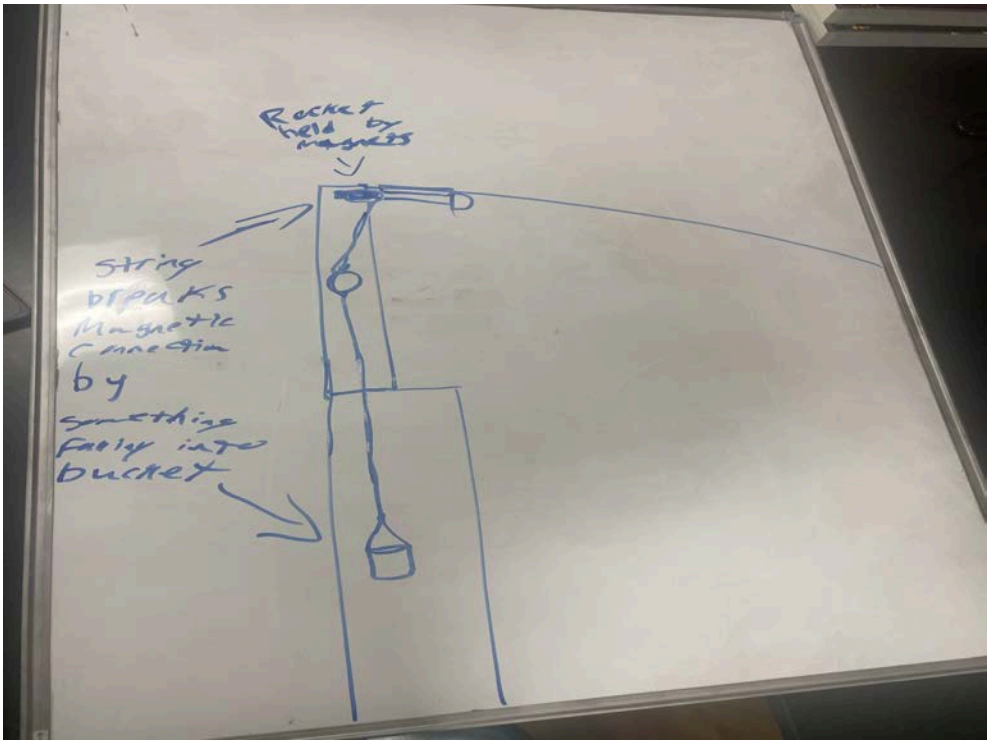
First day: Watching *Real Steel* and conceptualizing steps



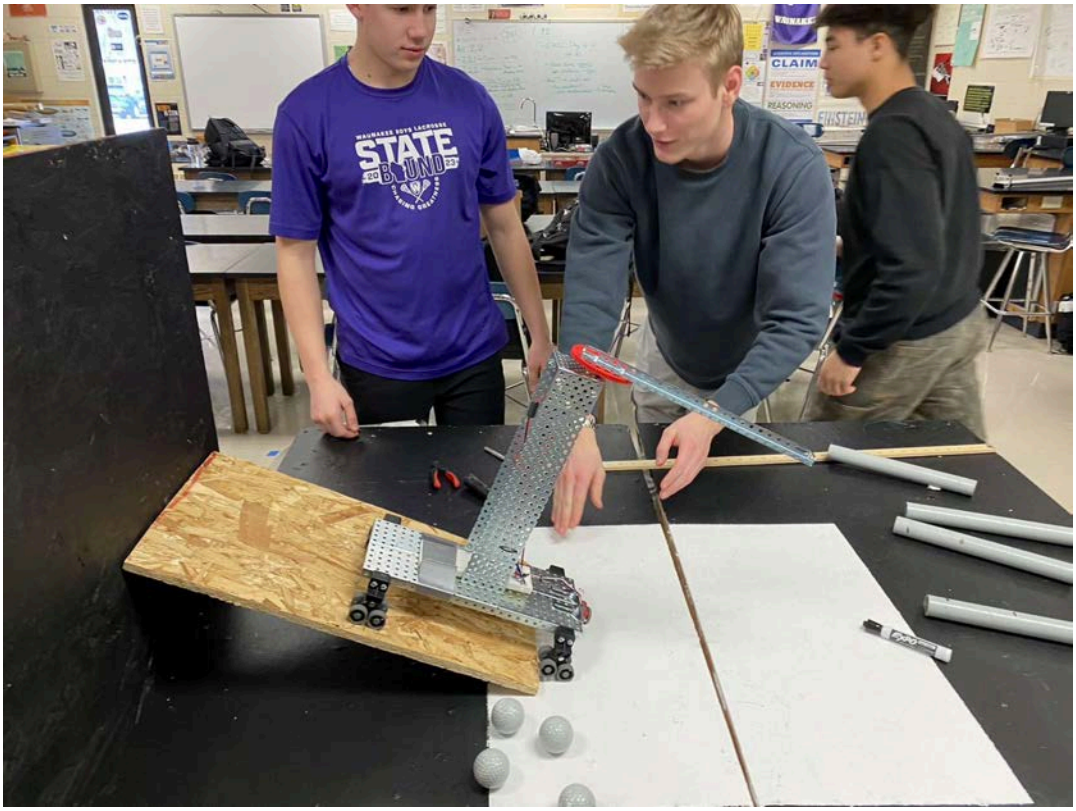


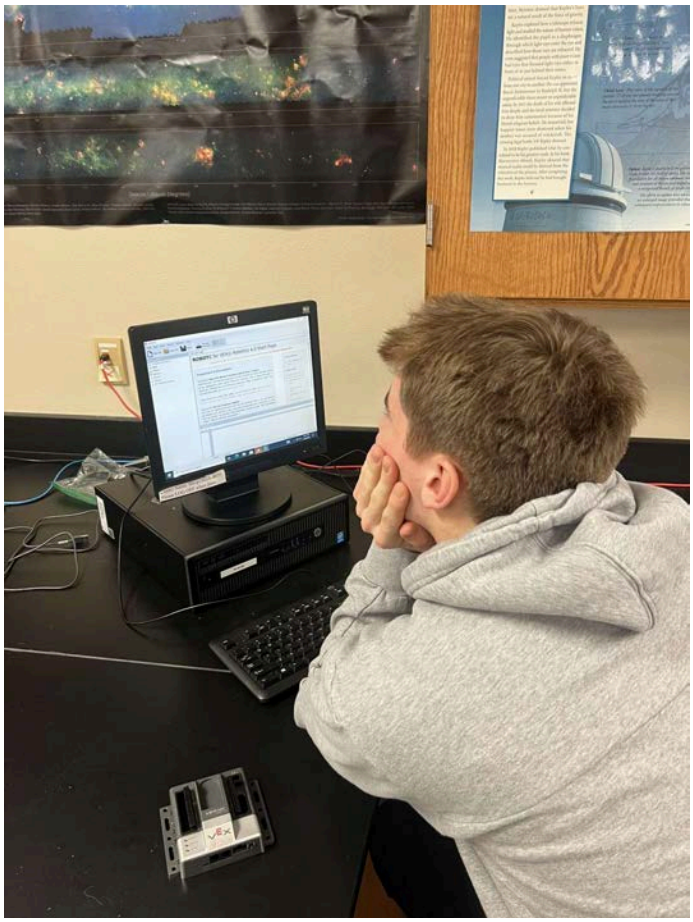


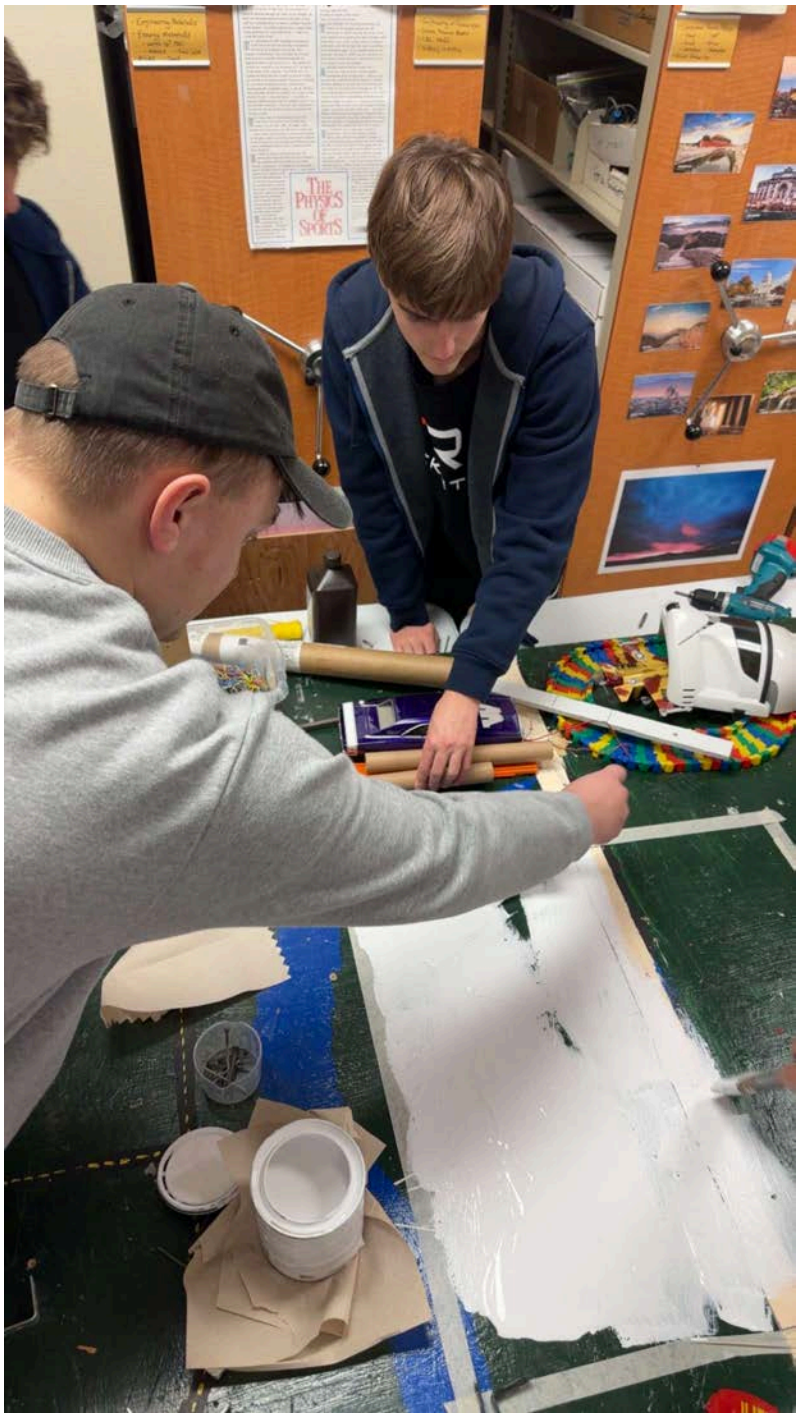
Brainstorming ideas



Construction





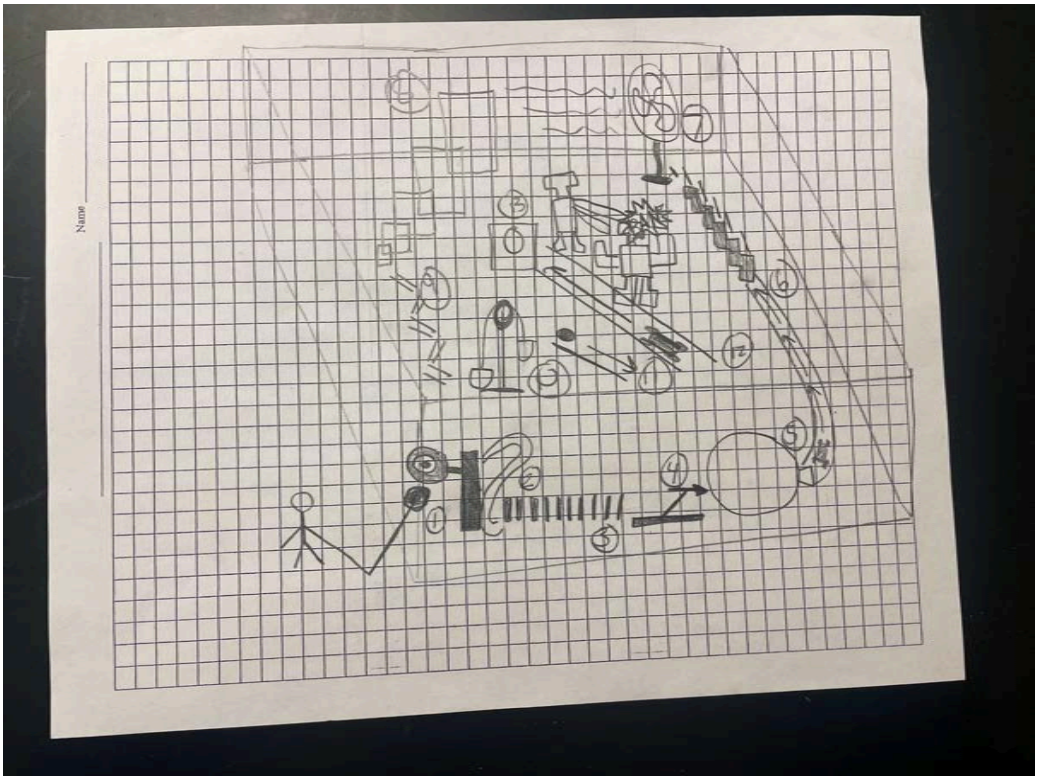

THE PHYSICS OF SPORTS


Alka-Seltzer
Alka-Seltzer


IOWA STATE


The two faces of light

Planned Machine Design Sketch and Description



Our initial design started with a human hand punching the target which knocks over dominos that then releases an arrow from a bow that pops the balloon and the balloon has a marble inside of it which drops into a funnel. The ball then goes down another tube knocking over a second set of Domino's which lands on a fan which turns the fan on. The fan blows over a set of books which hits a ball causing it to roll down into a Plinko board. The ball stumbles down onto a weighing scale which allows a ball to roll down a track hitting a button at the end of it. The button activates the Atom’s arm allowing the Atom to hit Zeus. As this was our first drawing with everyone’s ideas put together, some of the steps were a little more far-fetched than others and we knew some would have to get changed but we decided we would cross that bridge when we got there. We knew changes were bound to be made, but at least we had our starting ideas on paper.

Design Process

Define a Problem: Our problem was to create a machine to use multiple simple steps that worked together crescendoing to a robot punching another robot.

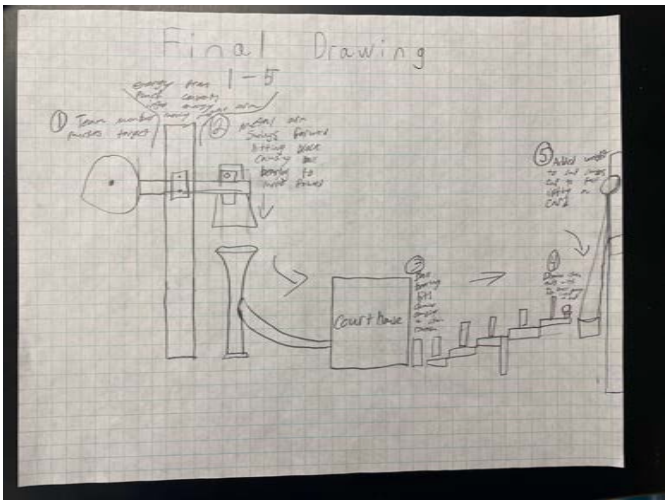
Generate Concepts: To generate concepts efficiently our group split into smaller groups each specializing in something different, each brainstorming their own ideas.

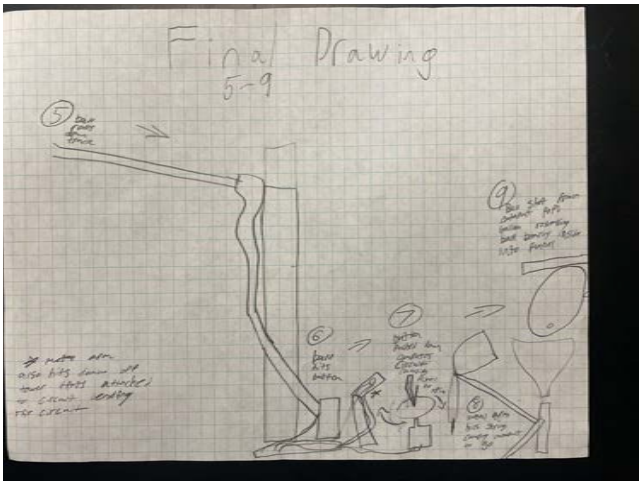
Develop a Solution: After some time we came back together hearing out each group's ideas and brainstorming ways to connect them. After some discussion, an initial drawing was made that we would then base our construction on.

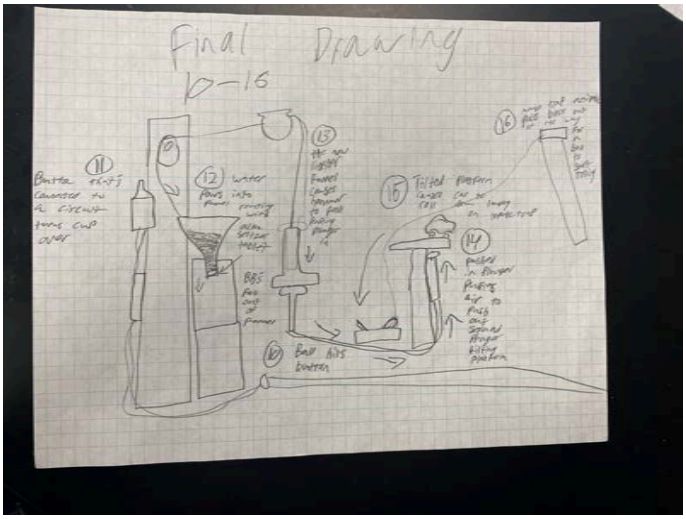
Construct Prototype: In our teams of 3-4, like in the previous design process step, we went to work on our steps. After some time of individual testing, we started to combine steps onto the board and continued to test and refine.

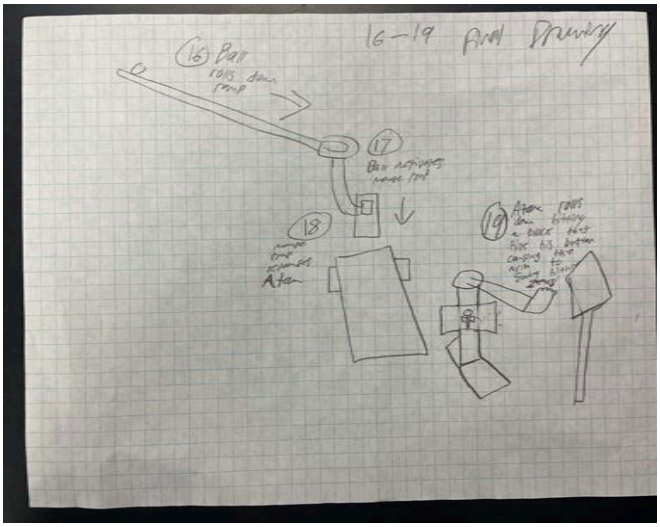
Evaluate Solutions: Over February and the beginning of March we made many different improvements and changes to the machine to best avoid unnecessary steps or issues.

Final Machine Drawing/Image and Description









In our machine design, we wanted to incorporate various chemical, electrical, hydraulic, and mechanical steps while maintaining a loose congruous theme physically and metaphorically. To achieve this we found ways to relate our steps to the movie while also adding our own creative twists and turns to tie into this dystopian narrative we have created. Through a profusion of scraped ideas and technical changes, our machine differed majorly from our original drawings. However, one aspect that stayed through all the changes was that our machine starts with a human punch that culminates into Atom punching Zeus, granting him the title “World Champion”.

Steps 1-5	The machine starts with a team member punching the target causing a ball to roll into a funnel starting the entire machine. The fifth step includes an extra, decorative, step of a rocket shooting off symbolizing the ongoing war, and ringing a bell symbolizing the start of the final fight.
Steps 5-9	Steps 5-9 contain our first electrical step where once the ball rolls down to the end of the track it hits a button. The button activates a circuit which causes a gear to turn the turning gear hits a string connected to a catapult causing the catapult to launch the the gear also hits a string that breaks the circuit causing the gear to stop spinning.
Steps 10-16	The ball continues down the tube to hit a limit switch that completes a circuit connected to a beaker full of water. This dumps the water in the funnel to chemically react with the alka seltzer tablets and release the bb's into a container. This releases weight and slowly lets a hammer press on a syringe through the use of pulleys. The now-pressed syringe is connected to another syringe and creates the plunger in the other syringe to lift away from the nose. The handle side of the syringe lifts up and knocks a match car into a mousetrap. The mousetrap is connected to a string which is connected to wrapped jenga blocks to let the balls go down the ramp.
Steps 16-19	Once the balls get to the end of the ramp, they are met with a funnel that directs them to a mousetrap that is connected to Atom. Atom is released

	to start down the ramp. Once he meets the end of the ramp, he runs into a block and this activates the button attached to Atom. This completes a circuit connected to a motor that turns his arm and releases the final right hook on Zeus.

List of Machine Steps

1. Team Member punches target that hits “L” shaped cardboard
2. “L” shaped cardboard flips onto its other side allowing a ball bearing to start rolling
3. The ball bearing rolls down the tube and hits a domino at the end of the tube
4. The domino starts a domino effect crescendoing into a metal ball being hit into a small red solo cup.
5. The cup raises a card causing a ball to start to travel down its path
6. The ball travels through tubes hitting a switch at the end of its path
7. The switch activates a motor that causes a gear with a metal arm attached to spin breaking a string loop’s tension
8. The string loop losing tension causes the catapult to activate launching a ball into a balloon and popping the balloon
9. The popped balloon releases a ball that travels down a tube path hitting a button at the end
10. That button activates the electronics causing the cup to rotate and dump water into a funnel
11. The water reacts with the alka seltzer tablet at the bottom of the funnel allowing the copper bb’s to fall out of the funnel
12. The now lighter funnel that is attached to a hammer through a pulley system drops the now heavier hammer onto a syringe
13. The now pushed-down syringe shoots air through the tube it's connected to and pushes the plunger of the other syringe up
14. The pushed-up syringe hits the end of a platform raising one end and causing a car to move forward
15. The car moves off the platform landing on a mouse trap
16. The mousetrap activates pulling a jenga block causing a ball to start to move down a ramp
17. The Marble moves down hitting a house trap at the end of its path releasing Atom
18. Atom rolls down the ramp hitting a stopper that presses a button
19. The button causes Atom to swing his arm hitting Zeus for the KO.

Material List

Recycled	Materials
Baseboard (2)	Duct Tape
Backboard (3)	Pulleys
Dominos	Weights
Wooden Planks	Water
Jenga Blocks	Alka Seltzer Tablets
Ball Bearing (5)	Wooden Catapult
Hammer	Screws
Funnel (2)	Plastic Cup
Plastic Tubes (2)	Hinges
Hot Wheels Tracks	Brackets
Toy Car (1)	Fishing Line
Cardboard Tubes (6)	Balloon (1)
Vex Kit Bracket	Syringe (2)
Vex Kit BreadBoard	Mouse Trap (2)
Vex Kit Gear	PVC
Wires	Golf Ball (1)
Cardboard	Bell ($5.59)
Paint ($16.99)	Screws
String	Battery Clips ($6.99)
	Roughly 95% of the project is recycled as only the bell, small electronic, and paint were not recycled
Total Cost of Machine	**$29.57**

Applied STEM Process

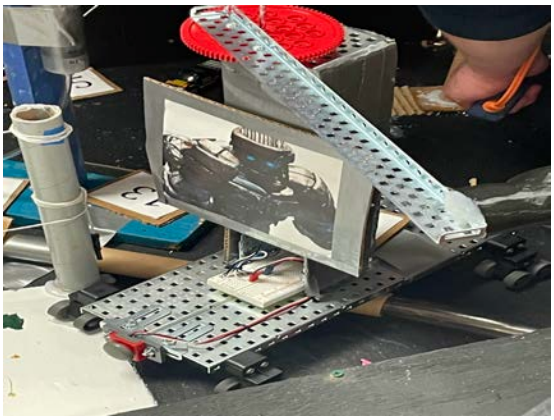
Chemical: Parker Andreson, Patrick Fraker, and Mina Khalil

$85H_2O_{(l)} + 5C_{16}H_{17}NaO_{14}(s) \rightarrow 70CO_2(g) + 12H_2O(l) + 5C_2H_3NaO_3(aq)$

Our chemical reaction is a water and alka seltzer tablet reaction which is triggered when a ball hits a button causing water to pour into a funnel with a tablet at the base. The water and tablet react creating CO_2 gas as shown by the bubbles rising to the surface. This reaction causes the brass bbs to fall out of the funnel allowing the funnel to rise.

Electrical: Carter Blackburn and Andrew Meintjes

One of the various electrical steps within the machine is the final robot step. The robot's interior is created using a breadboard which is connected to a large battery powering the robot arm due to a motor. Once the button on the front of the robot is pressed the circuit is complete and the motor activates, rotating the axle, causing the arm to swing around hitting Zeus for the K.O.



Fluid Power: Patrick Fraker and Jaxon Wipperfurth Our machine uses a fluid power step in an arrangement of two hydraulic pistons connected by a tube. The input piston is depressed using a heavy weight. As force is applied to one end of the apparatus, the internal pressure of the fluid increases, which is transmitted throughout the container, exerting force on the output piston which raises one end of a ramp. The input piston is smaller than the output piston, resulting in mechanical advantage due to Pascal's law.	
Mechanical: Greyson Quint and Brady Wallner While there are many mechanical steps throughout our machine, one that's apparent is in a simple machine we utilized the pulley. In step 12 we use a stationary pulley that consists of a grooved wheel mounted onto a fixed axle, with a string looped through. The string is tied to a hammer on one side and a funnel on the other. The hammer is held by a force of tension, and as that force disappears, caused by the BBs falling through the funnel, the force of gravity on the hammer becomes larger than the force of tension causing the hammer to fall activating the next step.	

Reflection

Through accumulated ideas and agonizing trial and error, this machine was constructed. Members pulled knowledge from previous classes which they then used to contribute to the wellbeing of the machine. For example, numerous different engineering classes taken by different members allowed us to better our machines in all aspects. Since everyone had some level of experience in a science and/or engineering class we all knew the importance of the planning and testing process. With this idea of trial and error, we ran into many problems, which we would later turn into success. An example of this would be the rocket hitting the bell. Although it wasn't as important as the other steps as it truly wasn't a step, it was undoubtedly one of the largest struggles from the entire machine. We knew we wanted to have a bell ring to signal the start of the fight, the issue came from how we would keep a rocket suspended in a ready position. Days were spent drawing up ideas and refuting said ideas for how this could be done. Finally, after much debate, magnets were decided on and they worked like a charm. The rocket was now suspended in air and staying in place but now a new problem arose: how do we get the rocket to move down the line? This one solution caused a new problem that stayed very consistent throughout the building process. Another obstacle we had to push through was the chemical reaction. Initially, we didn't fully get the water to react with the Alka seltzer tablets and when we did, there wasn't enough space to fit all of the BBS and release the weight from the funnel to continue the hydraulic steps. After different ideas were tested we found out that the temperature and amount of water were key for the reaction to occur. The last problem to mention was the catapult step. When the catapult launched the golf ball to create the force to pop the balloon against the screw, it would have bits and pieces from the balloon fly out of the machine. To fix this we attached pieces of wood and large pieces of plastic film to keep the balloon in place and control the pop. Overall, this project has given all of us involved a grand opportunity to represent our school and hone in on important skills that are guaranteed to be useful in the future regardless of the occupation.

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