Team Name Sumner-Fredericksburg Team 1



Team Members: Morgan Brandt Kathryn Dillon Katie Reno Lillian Sassmann Lane Smith

Contest Theme: Power the World

Team Theme: The World Uniting One Step at a Time

1. <u>Initial Sketch and Description of Machine Design Planned</u> *Daily Logs: Week One*

12/07/2021

The first day we did a lot of thinking about our structure and the theme, *Powering the World*. From the start, we knew we wanted a unique structure that emphasized the theme instead of a traditional square shape. We then came up with the idea of a 3-dimensional half sphere



12/08/2021

Today, we started thinking about how we were going to incorporate our theme of *Uniting the World One Step at a Time*. We thought about what steps we wanted to incorporate and our advanced components.

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2. Progress Photos Daily Logs: Week Two



12/21/2021 We took our half spheres down to the shop to cut them in half. Then, we sanded all of the wood.



12/20/2021

Our structure was cut over the weekend. When we had the pieces together we figured out how to put them together.



01/23/2022 We started painting our base.





Daily Logs: Week Three

12/27/2021

Kathryn finished painting the base.

12/28/2021

Kathryn, being the most artsy, did most of the painting at home over break so we could all start on steps after break.





12/29/2021

Kathryn started painting sides. She painted distinct features for each of the countries/continents on each of the quadrants.

12/30/2021 Kathryn finished painting most of the spheres.





Daily Logs: Week Four

01/05/2022

After sports practices, we came to the school to help move our rube back into the school.

01/06/2022

During class, we did finishing touches on spheres so we could start adding steps soon.



01/07/2022

All painting was completed today. We started drawing out our first steps so we could get right to work on Monday.





Daily Logs: Week Five

01/10/2022

We attached L brackets so we could assemble our rube making it all one piece.

01/11/2022

In class, we started by finishing with the attachment of L brackets. We started on the little details as well.

01/12/2022

We began jigsawing holes into our spheres so the train could run in a circle around our rube.

01/13/2022

We were able to finish jigsawing all the holes today.











Daily Logs: Week Six 01/17/2022

We came in and noticed that our boards were very warped, we then attached more L brackets to pull our piece of plywood together.



01/19/2022 We continued working on attaching steps.

01/20/2022

In class, we worked on perfecting our steps in quadrant one . We were able to finish all of our steps for quadrant one, we then moved onto quadrant two.





01/18/2022 We were able to add our first step to the rube.



01/21/2022 We drilled a hole to put our syringe tubing through to move quadrants.

Daily Logs: Week Seven

01/24/2022

Today, we noticed some steps were not right: we worked on them.

01/26/2022

We began working on our fluid power step.



01/28/2022

Today, we were unable to get the boat to transfer momentum to the third quadrant: we scratched the idea.





01/27/2022

Today, we worked on wiring a fan to a light switch. Our goal for today was get the fan to push a boat to our quadrant three.





Daily Logs: Week 8

01/31/2022

We redesigned many steps today because many of them didn't work the way we thought they would.

02/01/2022

Due to all the steps we took off yesterday we had to fill many holes on our board. We then continued the redesigning process for our steps.

02/02/2022

No school, throughout the day we had finished with all of our steps and had finally come to our final step of a flag flying on top of our project.



02/03/2022 In class, we ran our whole rube for the FIRST time and touched up paint.







02/04/2022 Did many finishing touches and ran our Rube for the first time.

3. Written Description and Image of Final Machine Design



Machine Description

Our machine is made up of two semi-circles on top of a square to form a world. Our team has steps all throughout the quadrants to move the energy throughout the world effectively and efficiently. Our steps are mainly simple machines such as pulleys, levers, and inclined planes. Our machine displays different murals from around the globe as well as different power sources, to show how our team powers the world one step at a time.

Storyline

Throughout history, the world has powered itself in a variety of ways. We start off in the first quadrant which represents Europe. We started off in Europe because the first train to be introduced was in 1804 in Europe.We moved on to the era of the Model T era, in our Rube we feature a car moving down an inclined plane. We also see solar panels in the Asian quadrant to represent China's solar power usage which is highest in the world with over 3.5% of their total energy capacity being solar power. We then see our fluid power step in the next quadrant, which showed how hydro-power was used throughout history. The first observance of hydro power was in China in 202 B.C. Soon after we see our chemical step, which shows a balloon filling up with

gas made by our reaction. The first natural gas well was discovered in 1821. The next quadrant shows many natural features on the south america side like the Izagha Falls and Machu Picchu. With all of these natural elements we thought this quadrant would be perfect to represent green energy sources. These include Biodiesal, geothermal, and biomass materials. Oue final step shows wind power blowing our flag in the wind. Over 8.4% of all power sources come from windmills in the United States as of 2021.

4. Written and Numbered List of Machine Steps Complete List of Steps

Step One: A team member starts the train by pushing the button on the train. The train releases a pulley which releases a mass that releases on marble. *Advanced Component: Electrical*

Step Two: The mass then drops which is attached through a pulley to a lever and raises the lever and releases a car. *Advanced Component: Mechanical*

Step Three: The car goes down a set of tracks and collides with a 500 gram mass. The mass falls into our syringe basket.

Step Four: The first plunger goes down, which causes the other plunger to go up. When the plunger goes up, a ramp is raised, and causes a mass to fall. *Advanced Component: Fluid Power*

Step Five: The falling mass causes a popsicle stick to be pulled out from in front of a car, and releases the car down a track. *Advanced Component: Mechanical*

Step Six: The car hits a mass, which falls, and utilizes a pulley system to activate the chemical reaction of vinegar and baking soda. *Advanced Component: Mechanical*

Step Seven: The chemical reaction is activated, creating carbon dioxide and filling the balloon. Once the balloon expands, it hits a car. *Advanced*

Component: Chemical

Step Eight: The car goes down a track, v activating a pulley system, by pulling the to be raised. *Advanced Component: Mech*Step Nine: Once the lever is raised, a bal

bearing goes through a funnel and drops Component: Mechanical

Step Ten: The lever is lowered, raising the ball bearing. *Advanced Component: Mec.*

Step Eleven: The ball bearing goes down the inclined plane and marble works and drops into a cup. *Advanced Component: Mechanical*Step Twelve: The cup is lowered and releases a popsicle stick, releasing a truck. *Advanced Component: Mechanical*Step Thirteen: The truck goes down the tracks and pushes a mass off of the end of the track. *Advanced Component: Mechanical*Step Fourteen: The mass falls, which activates a switch. *Advanced Component: Mechanical*Step Fifteen: The switch completes the circuit which activates the hobby motor with fan blades. *Advanced Component: Electrical*Step Sixteen: The fan then creates wind and causes our flag to blow in the

wind. Advanced Component: Mechanical



Item	Item Quantity	Origin	Price
4x8 Sheet of Plywood	2	Donated	\$50
L Brackets	12	Bought	\$3
Nut and Bolt Kit	5	Donated	\$1.43
Polyurethane	1 can	Bought	\$10
Popsicle Sticks	~65	Recycled	\$0
Colored Acrylic Paint	12 bottles (7 oz)	Donated	\$0
Wood Screws	6	Recycled	\$0
Dowels	5	Recycled	\$0
Toy Cars	4	Recycled	\$0
Ball Bearings	4	Recycled	\$0
Tupperware Container	2	Bought	\$3
Syringe	2	Recycled	\$0
Masses	500 g = 1 50g = 3	Recycled	\$0
Scrap Wood	3	Recycled	\$0
Fishing Line	4 meters	Recycled	\$0
Dixie Cup	2	Recycled	\$0
Plastic Cup	1	Recycled	\$0
Toy Train	1	Recycled	\$0
Train Tracks	11	Recycled	\$0
Gems	3 packs	Bought	\$3
Pulley	6	Recycled	\$0
Marble Tracks	2	Recycled	\$0

5. Cost of Machine and Percent of Recycled Materials Used

Total Cost: \$168.15 Total Number of Materials: 157 Total Number Recycled Materials: 120 Percent Recycled Materials: 76.43%

6. Written or Visual Documentation of Major Successes and Challenges

Successes

• Structure

 We believe that our structure was very creative and appealing to the eye. Our goal was to have a structure that was unique and unlike anything else. This is why we have a sphere shape to

represent the world.

• Aesthetics

• We believe one of the



paintings on our Rube was one of our strong points. Being that we incorporated many countries and nations around the world in the paintings and were able to build our rube around the countries.

- Chemical Step
- One of our biggest successes was our chemical step.
 We came up with the idea of putting baking soda in a bottle and vinegar in a balloon. The balloon lifts because of a pulley, and baking soda would be let into the bottle which would cause the chemical reaction.

Fluid Power





Challenges

• Our biggest challenge was arranging our Fluid Power

Step. One syringe pushes down on another to force it up. We struggled with the amount of force that was required to hit the syringe. After multiple attempts, we ended up having a car hit a 500 gram mass into a tupperware on top of the syringe making the syringe push down.



• Moving Momentum

 Moving the momentum of steps from different parts of the sphere was very difficult because we had to drill holes through our shape to move the energy from each quadrant; however, we were able to overcome this challenge with critical thought.

• Warping of Plywood

 During the beginning of our project our boards began to warp, because the room we kept it in was very humid. Therefore, we had to think about the best possible way to fix this and we decided to attach more L brackets to pull the pieces together.



7. Written or Visual Documentation of the Incorporation of Advanced Components

Our *electrical step* we would like to focus on is our fan. We wanted to show wind power and we knew the fan would be perfect to do so. A weight falls and the force of that flips a light switch for the fan to turn on.





Our *fluid power* step we would like to focus on is our syringes. We used a heavy force on one side to force the other side up and lift a lever. We knew this would be simple but it was also a big challenge for us.

Our *mechanical step* that we would like to focus on is the lever that releases a ball bearing into the funnel. The lever is tipped by the pulley it is connected to.





Our *chemical step* is a balloon filling up a flask full of baking soda. This was a simple step that took us a while to master. We have a pulley pull the balloon up from the force of the weights.

8. Team and Individual Reflections of Entire Process

Kathryn: The process of building and assembling this rube faced me with many challenges. I had to work effectively with my team to solve the issues we ran into. This will help me in my future when I go to college because critical thought required on this rube will be required for me in college.

Katie: Being involved in the Engineering Design Contest has taught me how to keep pushing to find an answer even when I could easily give up. There were many steps on our project that were very difficult and could have found an easier solution however, I learned to push through and not always take the easiest route. In my future I will be able to use these skills I learned by applying them in my everyday life at college by working my hardest in class and on the job site.

Lane: I learned a lot of things throughout the process of completing this Rube Goldberg Machine. I learned a lot on how to work with other people that don't think in quite the same way as me, and how to make the best out of hot glue and the materials we had. It really connects to my future career as a diesel mechanic because in that career we have to do a lot of critical thinking to get whatever we need done safely and quickly.

Lillian: Throughout the building process of the rube, we have encountered multiple challenges. One challenge that involved me the most was one of our electrical steps. My team needed to figure out a way to wire the light switch, and I had knowledge in wiring. I now know how to wire a light switch which can help me in the future for my house

Morgan: Participating in the Engineering Design Contest has advanced my learning and life skills. It has taught me how to persevere through a project when I am stumped. In my future life and career, I will be able to use these skills when I have a problem. I will have to work with my coworkers to solve the problems. You cannot run away from the problem, you have to face it full force.

9. Word Count

Word Count: 2431

<u>10. Bibliography</u> References

Keam. (2013, February 22). "*Easy*" Rube Goldberg machines [Video]. Youtube. https://www.youtube.com/watch?v=GE6WXcMbWnE

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