

A Bean on Mars

Mr. Bean

Augusta High School

**Connor Ziwisky, Devin
Molinaro, Sam Waller,
Wyatt Sudbrink, James
Littlefair**

Mr. Catt

Base

3 Plywood Sheets - Machine Dimensions 4 x 4 ½ (Easy to cut and work with)

2x4's on bottom in square for support and to function as legs.

Back wall also has 2x4's for support

Boards or Plastic to hold in play sand- Orange play sand to emulate Mars.

Drain built in to base

All Painted White to keep space/NASA theme

T20 Head deck screws of various lengths will hold together.

Backboard possibly painted in a gradient to emulate mars atmosphere.

Possibly one layer of clear coat to keep paint safe in transportation

LED Strips- WLED | ESP 32, Light Diffusing Channel, Led Strip and Power Supply

Cable Channel for Clean Look

Step 1

Supplies Needed-

Wire Snippers

12V Power Supply/ Battery

Wago Connectors

Fan

Button

18 AWG Wire

Soldering Iron

Small Solder

Button gets pushed which redirects air onto an object

Step 2

Flat Object Falls

Light Enough to be pushed over

Heavy Enough to push a button

Plastic?

Paper?

Magazine?

Step 3

Button for pneumatic piston gets pushed

Materials Needed-

Air Compressor

Air Tank on Machine

Pneumatic cylinder

Hose Fittings

Soft Tube Airline

Pneumatic Piston will extend and retract.

Step 4

Hatch gets opened with dirt and ball magnets inside

Materials Needed-

Container (Wood?, 3D Printed?, Aluminum?, Bolts and Container cannot be magnetic)

Dirt

Ball Magnets

Maybe a hinge

The hatch and container will hold the magnetic balls and dirt and allow them to fall out when the pneumatic cylinder is extended.

Step 5

Metal lever gets pressed - Magnets stick/Dirt Falls into Pot

Materials Needed-

Metal Lever that is magnetic (Somewhat light)

Bolted Down

Hinging Mechanism [Maybe]

Step 6

Lever Connected to Container of Baking soda through the use of a string/fishing line.

Materials Needed-

Container

Baking Soda

String/Fishline [Definitely No Yarn]

Container mounted to Hinge or Bearings

Step 7

Baking Soda and Vinegar Reaction

Materials Need-

Vinegar (12 to 1 ratio for best results)

Measuring cups

Container

Large Fishing Bobber

Drain

Drain will be connected to this step for ease of access for a reset.

Bucket will also be need to collect leftover baking soda/vinegar.

Step 8

Mouse Trap gets set off with string/fishing line attached

Materials Needed-

Mousetrap

Fishing line/String

Pulley

Something to elevate pulley (Scrap 2x4, etc.)

Step 9

Baseball Released

Materials Needed

Baseball

Plastic, Wood, or other material to use for a gate

Hinge(Maybe)

Step 10

Baseball released marble

Marble goes down a marble run

Materials needed-

Marble

Marble Run Funnel

Pex Pipe

Step 11

Marble Hits bean and plants in the pot

Materials needed

Pex tubing (Possibly clear tubing so bean can be seen when it is being planted)

Bean seed

Step 12

Baseball falls on balance scale

Materials needed

Balance Scale

Fishing Line

Step 13

Balance Scale pulls down filament spool and water bottle.

Materials

Filament spool

Water Bottle

String/Fishing Line

Bearings

Step 14

Water is poured down a watertight tube onto the waterwheel

Materials Needed-

Pex tubing

Funnel

Mounting Hardware for tubing (Strong Enough to hold weight of water bottle when full)

Step 15

Waters plant and water wheel spins

Materials needed-

Mounting hardware

Water wheel

Spool

Fishing line/string

Step 16

Water wheel pulls down object.

Materials Needed

Object (Not too heavy, not too light)

Step 17

Stamp gets pressed marking the time the mission was a success in a “Mission Log”

Materials Needed

Stamp

Paper

Step 18

Lever also gets pressed by flat object getting pulled over

Materials needed-

3D printed or wood lever

String/fishing line

Possibly a pulley

Step 19

Hammer falls over from lever pulling

Materials Needed-

Hammer (Not too heavy)

Hinge mechanism to guide hammer

Step 20

Stomp rocket gets set off by hammer

Materials list-

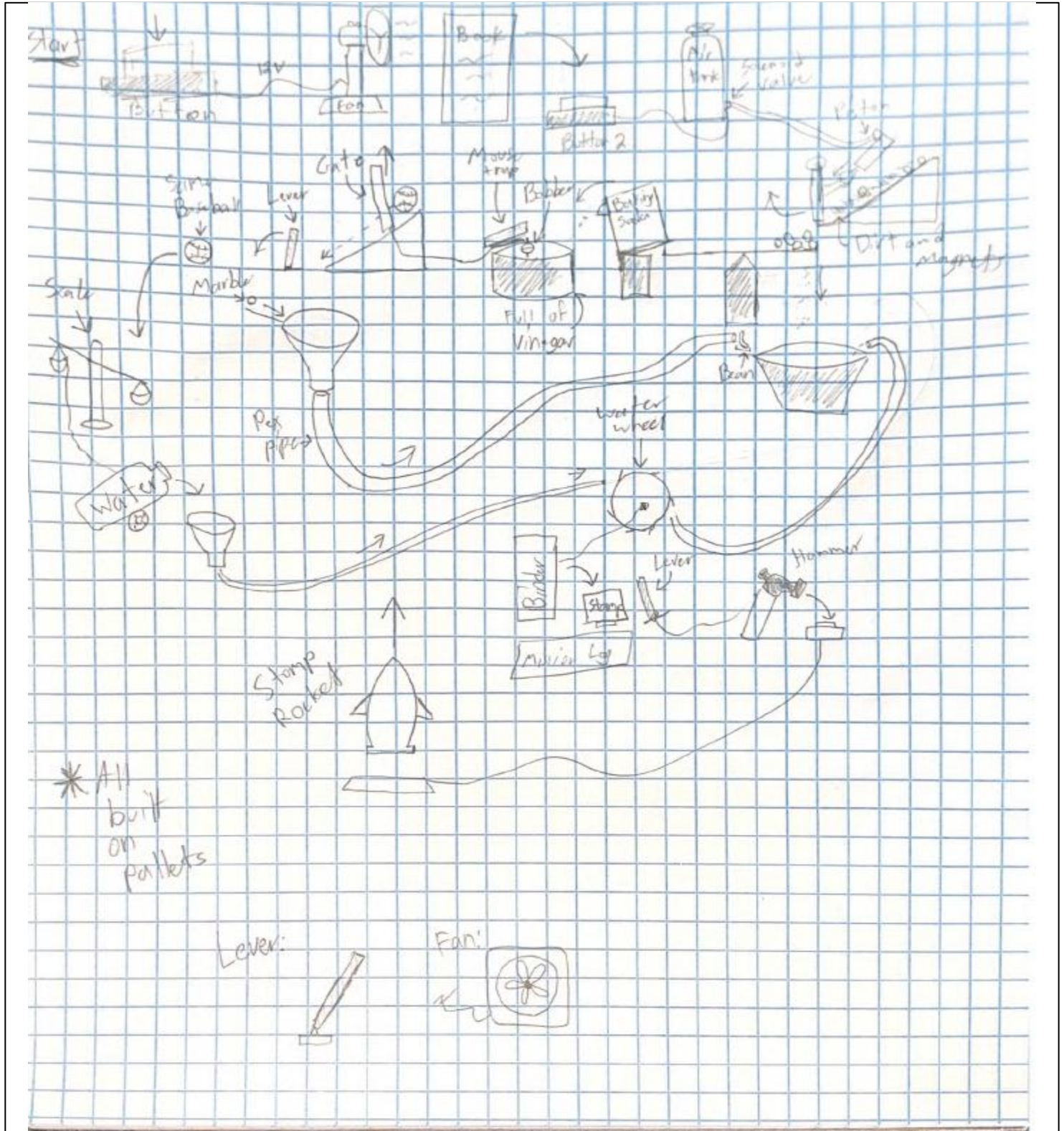
3D printed stomp rocket

Possible rail for rocket to follow.

Planned Machine Design Sketch and Description | Sketch of planned machine with clearly articulated description of planned machine including labeled components with technical details (i.e. anticipated transfers of energy, directions of force, materials, etc.). This is the team's original plan, prior to building

Our first step consists of a button being pushed and allowing a 12v fan to spin up. We will accomplish this by soldering the wires together and using a 12v power supply. Our second step consists of a magazine or book getting pushed over. The airflow from the fan will be directly applied to the book pushing it over. This will then push a button. The button will be directly connected to a solenoid valve. This solenoid valve will be connected to a air tank. When the button is pressed the air will be redirected into a piston pushing a door open. When the door gets pushed open, dirt and rare earth magnets will fall onto a lever. The magnets will stick to the lever and the dirt will fall into a pot below. The metal lever will then tip a cup of baking soda into a container. It will do this by pulling the cup attached to a hinge with a piece of fishing line. The baking soda and vinegar will then cause a reaction. A bobber will be sitting in the baking soda and vinegar causing it to float up. When it floats up it will actuate a mousetrap. The mousetrap will pull a string attached to a gate. The gate will allow for a baseball to roll down a track. The baseball will eventually run into a lever allowing for a marble to be released. The marble will slowly make its way through a funnel and into a pex pipe. It will finally make its way down and hit a bean knocking it into a pot. While the marble step is happening the baseball continues rolling. The baseball will fall down onto a balance scale mechanism. This will cause the balance scale to drop down where the baseball is. A string will be attached to the other end of the balance scale and pull down a water bottle attached to a bearing. This will allow the bottle to pivot into a funnel. The water will then flow down a tube. It will go onto a waterwheel and spin with the flow of the water. The water will then water the plant. The waterwheel will wind up a string and tip over a binder. The binder will actuate a stamp onto a mission log. It will also set off a lever that tips over a hammer. The hammer will activate a stomp rocket completing all of our steps. All of this will be on 3 pallets one will be a base and lay horizontally. The other two pallets will be used as a back wall to mount steps on. To provide a more sturdy and functional base, the pallets will be covered with a layer of plywood. Too add a layer of decoration to make our machine match the theme even better, we will add a layer of paint, play sand, and posible led strips to make the machine more space themed.

Final (or Near Final) Machine Design Drawing/Image and Description | Drawing or image of final machine with clearly articulated description of machine and labeled components with technical details (i.e. observed transfers of energy, directions of force, pertinent material specs, electrical details, etc.).



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List of Machine Steps | Clearly describe and number machine steps. Advanced Component steps clearly identified.

1. Fan pushes over an object
2. Flat Object Pushed Over
3. Button gets pressed setting off a pneumatic cylinder. This will occur due to a change in power sent to the Solenoid and will redirect the air into the piston.
4. A hatch gets opened on a container allowing dirt and magnetic balls to fall out.
5. A magnetic lever will get pressed by the dirt falling down and the magnetic balls sticking to it.
6. Tips baking soda into container.
7. Vinegar and baking soda mixed in a 12 to 1 ratio causes large reaction to make a large fishing bobber float up.
8. Mousetrap gets set off due to bobber rising from baking soda and vinegar reaction.
9. String attached to mousetrap lifts up a clamping mechanism holding a baseball in place.
10. Baseball roles and releases marble with a mechanism
11. Marble rolls down track and hits bean to plant
12. Baseball falls on balance scale
13. Balance scale pulls a bottle of water over into a funnel
14. Water follows watertight tube and hits waterwheel
15. Water causes water wheel to spin and also waters plant
16. Waterwheel pulls down flat object
17. Stamp gets pressed marking the time in a "Mission Log"
18. Lever is also pressed by flat object
19. Lever pulls a hammer down
20. Stomp Rocket gets set off by hammer

Cost of Machine and Percent of Recycled Materials Used | Complete itemization and calculations of machine cost and percent of recycled materials provided.

Item	Cost
3 Pallets	Recycled
Mousetrap	Recycled
Pulleys	Recycled
Bearings	Recycled
Waterwheel	Recycled
Muzata Spotless Led Channel	35.99
Tailonz Pneumatic Air Tube Kit	14.99
Tailonz Pneumatic Air Cylinder	20.99
Tailonz Pneumatic Solenoid Valve	14.99
Kayak Drain Plug	3.99
12v Power Supply	22.99
18 Gauge Silicone Wire	13.98
Wago Connectors	14.79
Cable Raceway Kit	14.99
Protechnic 120mm 12v Fan	19.99
Neodymium Magnets	8.49
Door Hinges	4.99
Fishing Line	Recycled
Bober	Recycled
6mm Shafts	8.99
Super Glue	Recycled
Measuring Cup	Recycled

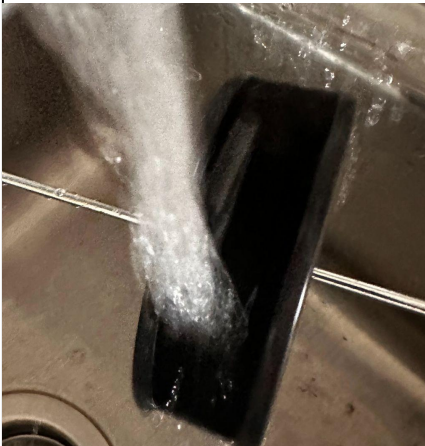
Cost of Machine and Percent of Recycled Materials Used | Complete itemization and calculations of machine cost and percent of recycled materials provided.

Item Baseball	Cost 6.49
Balance Scale	18.88
Screws	Recycled
4-2x4x8 Construction Lumber	12.48
3-1/2x4x8 Plywood Sheets	63.78
3- Rust-Oleum® Painter's Touch® 2X Ultra Cover® Flat White General Purpose Spray Paint	15.96
2-Rust-Oleum® Painter's Touch® 2X Ultra Cover® Matte Clear General Purpose Spray Paint- 12 oz.	10.64
34% Recycled	Total 357.38

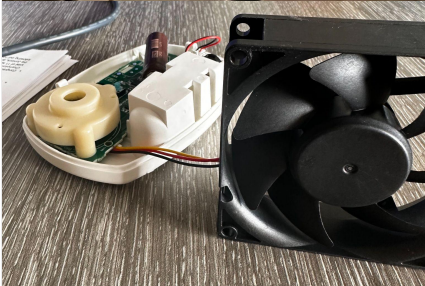
Applied STEM Processes | Documentation (i.e. sketches, photos, etc.) of four or more applied STEM processes with clear details provided

- labels on sketched/images
- arrows indicating direction of motion/force
- written explanations

For Senior Division teams, this section should include the Advanced Components.



Fluid Power- The image shows a 3D printed waterwheel powered by the force of the water.

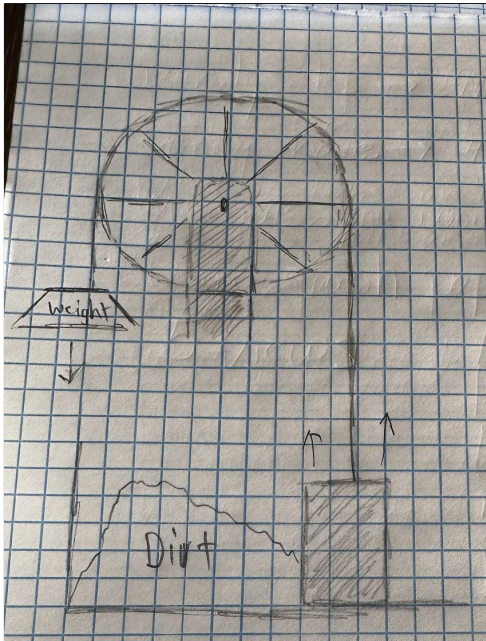


Electrical Step- This image shows a carbon monoxide sensor capable of activating a connected fan (via solder) to start another step.

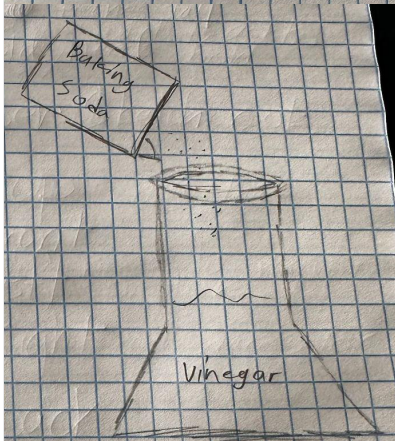
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Mechanical Power- This step shows how a pulley interacts with other objects to represent mechanical power. (Weight lifting object due to design of pulley)



Chemical Energy- This step shows the chemical reaction that is going to happen between our baking soda and vinegar step.

Reflection (1,500 word limit)

Reflection highlighting

- learning or growth (i.e. hard or soft skills, knowledge, etc.) from start to end of build and
- connection to future application (i.e. future classes, projects, career, life).
- Three or more major successes/challenges identified with clear details.
- Include final word count. Reflections greater than 1,500 words will result in a 10-point penalty.

Our group has been impacted greatly by this machine design contest. Over the course of the machine design process our team has learned many skills. While building our machine we realized that procrastination is not the key to success. The machine design process has taught our group many soft skills like working together to get a project done, communicating, teamwork, and many other things. We also established many hard skills like wiring, soldering, balancing items for specific steps, and learning about fluid motion. The skills we learned through the machine design contest can be applied to our future classes and overall life because all the skills we learned are used throughout a person's life. Throughout the process of building and acquiring materials, our team learned how to better make time and utilize the resources available to us. One major success we had was finding the materials needed that still fit in our budget. A challenge we faced was working around school hours and any days the school wasn't open. Another success we faced was being the first group to attend the event from our high school.

Bibliography | Four or more credible references listed with clear relevance to technical aspects of project.

<https://www.youtube.com/watch?v=sF-NxTRtqZg> - This video shows how to wire different types of 12v fans like the one we have to a power supply.

<https://www.youtube.com/watch?v=dR95umuNSPY> - This video shows how to wire and plum a pneumatic cylinder.

<https://www.thingiverse.com/thing:7715> - This is the stl file to 3D print the water wheel used in our machine.

<https://www.thingiverse.com/thing:5232111>- This is the stl file to 3D print the stomp rocket used in our machine.

Diary of building process, photos, team biography, etc

Connor

A tinkerer by nature. Connor plans on attending UW Stout to pursue a degree in Computer Electrical Engineering. Some personal STEAM activities include 3d printing.

Devin

When not found running cross country or track, it is common to find Devin M. in the Band room practicing his musical talents, for sure putting the Arts in STEAM. He plans on attending CVTC for physical therapist assistant.

JT

James, 'JT' Littlefair has a natural curiosity for design and engineering, a zest for figuring out how things work. He makes natural connections to traditional academics to hands and industrial applications. Engineering and Piloting are two areas JT is considering for future careers.

Sam

Easy going, and musically inclined, Sam provides a grounded perspective for his team and those around him. The future is Sams proverbial Oyster and is narrowing down what he wants to do with his life, perhaps Business, perhaps music.

Wyatt

If you wanted to be plied by musical talents, Wyatt is the person for you. The phrase 'outside the box' thinker describes Wyatt very well. He is perhaps the Yang to the Ying that is the grounding of Sam. If you need creative ideas, you go to Wyatt.