STEAM FORWARD – EPISODE 7
Keep the Engines Running [Teacher version]

Welcome to STEAM FORWARD!

Engineering is vital to keep the mill running!

Career: Mechanical Integrity Engineer
Episode: Keep the Engines Running

Georgia-Pacific's Savannah River Mill is home to five of the world's 12 largest tissue paper machines.

And they run mostly on recycled fibers to produce everyday products like paper towels. To keep these machines running 24/7 and produce enough paper to make 40 million cases of product each year, the mill needs to stay in tip-top shape.

During this episode, hosted by Dr. Meisa Salaita, Mechanical Integrity Engineer Renee Shepard shows us how she puts engineering into action every day to keep Savannah River Mill's production running.

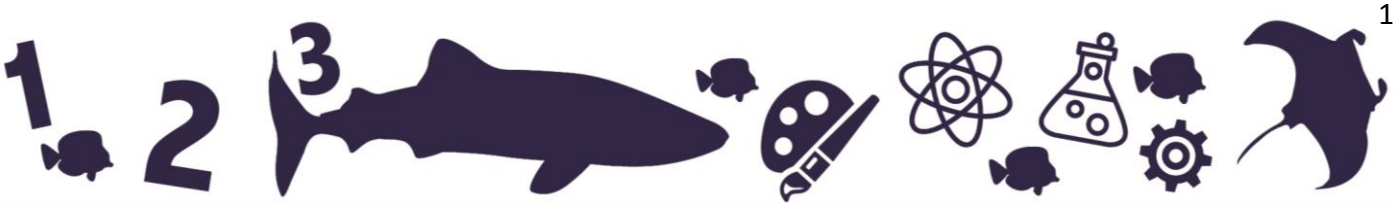
OBJECTIVES: Why am I learning this?

At the completion of this mini-unit, you will be able to:

1. Develop a design solution for a problem.
2. Make improvements on your design.
3. Present solutions to your class.

THE ESSENTIALS: ASK & ANSWER

1. What is the engineering design process?
2. What are design challenges?
3. What are design solutions?



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Video segment: 0:00-2:33

Activity 1

OBJECTIVES: Why am I learning this?
At the end of this lesson, you will be able to:

1. Develop a design solution for a problem.
2. Make improvements on your design.

This activity will ask students to become engineers and to identify design problems and develop ideas for how to solve these problems. This is a student-led investigation so they should be allowed to think broadly and creatively. Because engineering is usually a very collaborative process, this is a great exercise for teams. Teams of 2-4 individuals are ideal. Answers may vary widely for all of the questions in this activity; accept all reasonable answers that identify real problems and why these problems exist. To help students, you may want to use questions to assist them in choosing a machine. For example, ask them "Have you or your parents had something break or fail?" " What happened?" "Why do you think it happened?"

Introduction

We are going to work to develop a design solution for a problem. But you get to pick the machine and the problem that you want to solve!

Your first step is to choose a machine that you would like to improve on. It could be something from around the house, a machine in industry, or a way to get around. It's up to you!

1. I am going to work on improving _____.

Now, its time to do some research. Use the internet, your experience, or the experience of others you know to list some of the big design challenges or areas where the machine could be improved.

2. Use your research to fill out the table below. Come up with at least three design challenges!

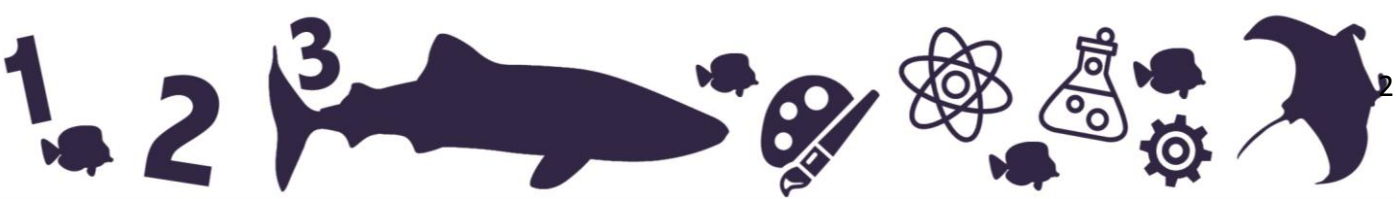

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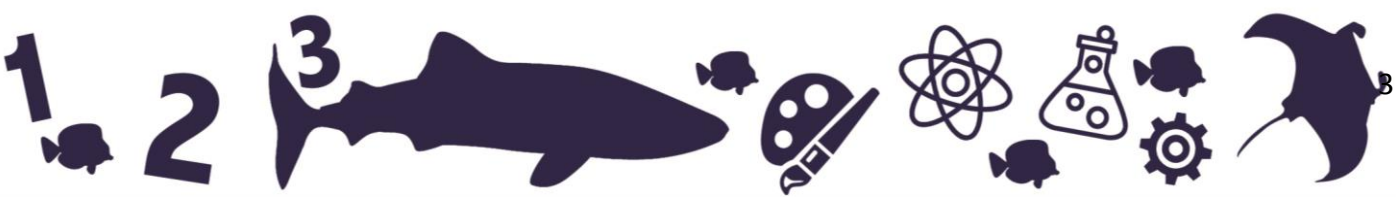
Table 1. List of design challenges for _____.

Part of the machine that needs to be improved	**Description of the design challenge (why does it need to be improved).**

3. Choose one of the design challenges that you want to work on.



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Activity 2

Video segment: 2:37-5:21

OBJECTIVES: Why am I learning this?
At the end of this lesson, you will be able to:

1. Design solutions for your problem.

In this activity, students should focus on thinking about how to improvie the design of the machine they choose. Encourage them to make a drawing of how they might make improvements. Have them describe, in full senteneces, what these improvements are and consider what challenges to success might be.

Introduction

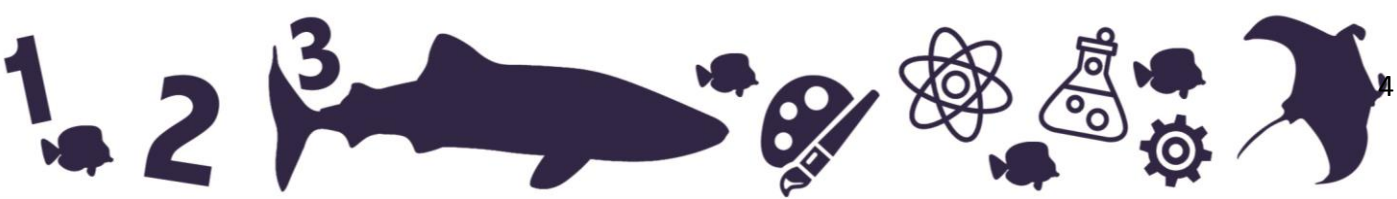
Now it's time to come up with ideas for how to improve the design of the machine! Work with your group to brainstorm how to improve the design of the machine. Come up with at least two possible design solutions. In the space below, draw a diagram of the original machine and your proposed design solution. Label your diagram and describe how this design improves on the original, and then identify potential challenges to developing the new design.

1. Solution 1 Description:

Diagram:

Description of Improvements:

Potential Challenges for Improvements (what might go wrong?):



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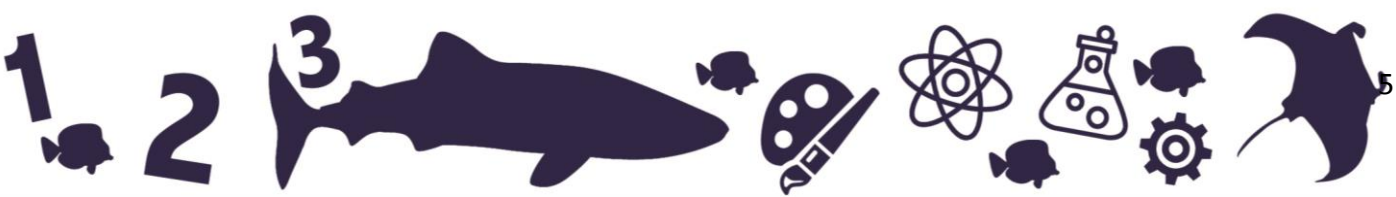
2. Solution 2 Description:

Diagram:

Description of Improvements:

Potential Challenges for Improvements (what might go wrong?):



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Activity 3

Video segment: 5:25–6:36

OBJECTIVES: Why am I learning this?
At the end of this lesson, you will be able to:

1. Describe design solutions.

Introduction and Activity

Create a poster or computer presentation for your class to describe the design challenge and your solution. Present to the class.

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In The Field

What better way to bring STEAM FORWARD alive than to meet an expert at Georgia-Pacific? Here, you will learn more about the background and experience it takes to be a member of the STEAM TEAM. Let's get up close and personal!

MEET AN EXPERT

Meet: Renee Shepard, Mechanical Integrity Engineer
North Carolina State University
Major: Mechanical Engineering

What is the most exciting part of your job at Georgia-Pacific?

The most exciting part of my job has been interacting with the equipment operators and the equipment to solve real-world problems. The equipment can't speak, but if you have a keen eye and you are a good detective, the equipment can tell you so much by noticing wear patterns, certain noises, etc. The operators also provide valuable information on how they would like the equipment to perform and to be designed. They also can help you understand when it may be time to repair or adjust the equipment based on changes they notice during operation.

What advice do you have for students interested in doing what you do?

Find adults working in the same fields of interest. Ask them questions to get them to share what they do, and see if they can show you their workplaces. Be brave enough to follow your interests and passions.

What is something surprising or unexpected about your career path?

I had no idea I would be able to climb inside equipment and machinery (that's properly locked out and not operating) to view things from a unique perspective and to see equipment parts most people don't ever see. It provides invaluable information on successes and failures in equipment design and repair.

What do you say to students who ask "Why am I learning this?"

While not everything in school is used directly in the workplace, it's important to remember the bigger picture for your overall learning experience. Learning different subjects and methods trains your mind on how to

approach, research, and solve problems. It may also help you understand the basis of things you will use in the future. An example would be learning calculus but using an end formula derived from calculus to solve water flow through pipes.