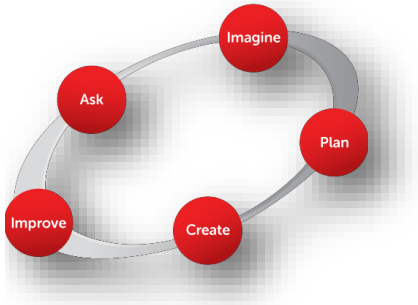
2020 Guiding Questions for the SRC Engineering Design E-Portfolio

Directions: *Each student team should use the following questions to guide the design of the Robotics Engineering Design E-Portfolio. The guiding questions below reflect various concepts that must be explored and investigated in each step of the design process.*

Scenario:



You work in the research and development department for a local amusement park. Your job is to develop a set of fun games that can be packaged and sold to families and schools. These games will provide additional revenue for the company and help offset the loss of revenue incurred in the winter months. Additionally, these games will be showcased in the spring at the new Virtual Reality Theme Park. Customers will immerse themselves in the robots and try to complete the challenges wearing virtual reality headsets. You must design a robot that can complete the task given for each arena. Furthermore, you must analyze your robot's performance.

STEP 1: Ask (Write a Detailed Problem Statement)

- What is the problem?

STEP 2: Imagine (Do your research, brainstorm possible solutions, analyze ideas)

Part I: Research the Problem

Answer the following questions based on their relationship to the amusement park ride. Click on the blue hyperlinks to open the presentation. Mentors may have to assist students with some of the terms presented. The goal is to understand the evolution of theme parks and how STEM has supported this growth.

Video: Axis Prototype

Roller Coasters

- What does it feel like when you are experiencing high g on a roller coaster ride?
- How long does it take the space shuttle orbiter to travel from the ground to orbit?
- What is the KC-13S?
- How is the KC-13S's flight path similar to a roller coaster?
- Explain the difference between wooden coasters and steel coasters?

Video: History of Roller Coasters

Loop Coasters

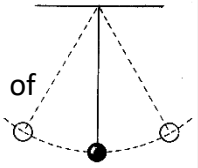
- What sensation (high g, low g, or normal g) do you experience most when riding the inside loop of a roller coaster?
- How is the force you experience in a loop different than the sensation you have going over the top of a floater hill?
- When does a KC-13S fly in banked curves for extended periods of time?

Video: How Do Bumper Cars Work

Bumper Cars

- You collide head-on with another car. Describe how Newton's third law of motion applies.
- How does Newton's second law of motion apply to a rocket launch?
- How much microgravity experiment time does a sounding rocket provide?

Pendulum Rides



- When is high g experienced on the KC-13S?
- When is high g experienced on a pendulum ride (as the rider reaches the bottom of the arc or as the rider reaches the top of the arc)?
- When is low g experienced on the pendulum ride?
- What is the difference between the flight path of the KC-13S and the circular motion of the pendulum ride?

Part II: Brainstorm and Select Best Possible Solutions

- What are some solutions to the problem identified in Step 1?
    - Brainstorm ideas
    - Describe the pros and cons of your brainstormed ideas.
    - Choose the best one
    - Explain why you selected the appropriate solution to this problem.

STEP 3: Plan (Design your solution to the problem identified in Step 1)

- What are the most important design requirements for your robot?
- Draw a diagram?
- Make a list of materials that you will need.
- What techniques will you use to construct your robot?

STEP 4: Create (Develop your solution to the problem)

- Describe how your team developed its robot prototype.
- Describe the lessons you learned while programming and building your working robot.
- Describe the procedure your team used to test the robot prototype.
- What data did you collect? Why is the data important?

STEP 5: Improve (Evaluate your solution)

- What works? What doesn't?
- What could work better?
- How will your team use the data collected to improve the prototype?
- Modify your design and write a reflection on the final product.