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# Engineering Design Process

*in the world of*

# Disney Imagineering

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A description of the engineering design process and a comparison of how Disney Imagineers and VEX IQ robotics teams approach its application; an explanation of how robotics is preparing students for a life as a Disney Imagineer; a list of resources available to students of robotics interested in more research.

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***Submitted by Isaiah Bass***

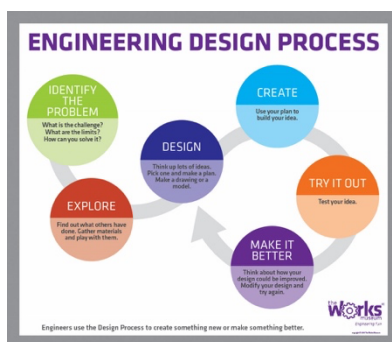
***Leo Robotics 141A  
Leo, Indiana***

## Introduction

My VEX IQ team begins its annual competition cycle each autumn. The coach introduces the challenge, describing the goals and constraints we must consider as we design and build the robot. Thus begins the *engineering design process*, “a series of steps that engineers follow when they are trying to solve a problem and design a solution for something; it is a methodical approach to problem solving” (VEX Robotics).

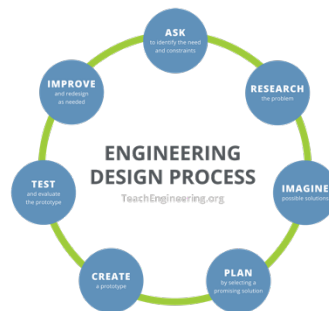
This season is my fifth watching the engineering design process guide the building and competition of VEX robots. “There is no single universally accepted design process...The process generally starts with a problem and ends with a solution, but the middle steps can vary” (VEX Robotics).

## Various Engineering Design Process Models



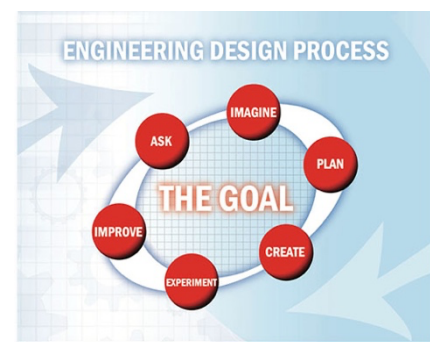
**The Works Museum**

<https://theworks.org/educators-and-groups/elementary-engineering-resources/engineering-design-process/>



**Teach Engineering**

<https://teachengineering.org/populartopics/design-process>



**NASA STEM Engagement**

<https://www.nasa.gov/audience/foreducators/best/edp.html/>

## 11-Step VEX Robotics Design Process

### 1. UNDERSTAND – Define the Problem

Our coach defines the problem, listing the objectives, field design, obstacles, and design and dimensional constraints. We ask: What does the robot have to do?

### 2. EXPLORE – Do Background Research

Students divide up the problem, each responsible for studying their part and discovering potential solutions. We use books, websites, smart adults – whatever we can find – to solve the problem.

### 3. DEFINE – Determine Solution Specifications

This year our robot had to catapult a ball into a box at the field's center. We had to design the robot's specifications within the constraints VEX places on the robot AND the competition field.

### 4. IDEATE – Generate Concept Solutions

Each person reports back potential solutions, design ideas, and available resources. We record everything in the engineering notebook...pictures, notes, dimensions, etc.

5. **PROTOTYPE** – Learn How Your Concepts Work

*Then we test the ideas. Some work well; some do not. With each prototype, we learn something important; and we record our findings.*

6. **CHOOSE** – Determine a Final Concept

*We narrow down our ideas and agree on a design.*

7. **REFINE** – Do Detailed Design

*We build the robot, listing parts and final design in the engineering notebook.*

8. **PRESENT** – Get Feedback & Approval

*Before the competition, our coach reviews and approves our final design. And at each competition, we present the robot to judges and other experts for feedback. We carefully record all that we learn.*

9. **IMPLEMENT** – Implement the Detailed Solution

*Then we compete...repeatedly. Each time, we observe the robot.*

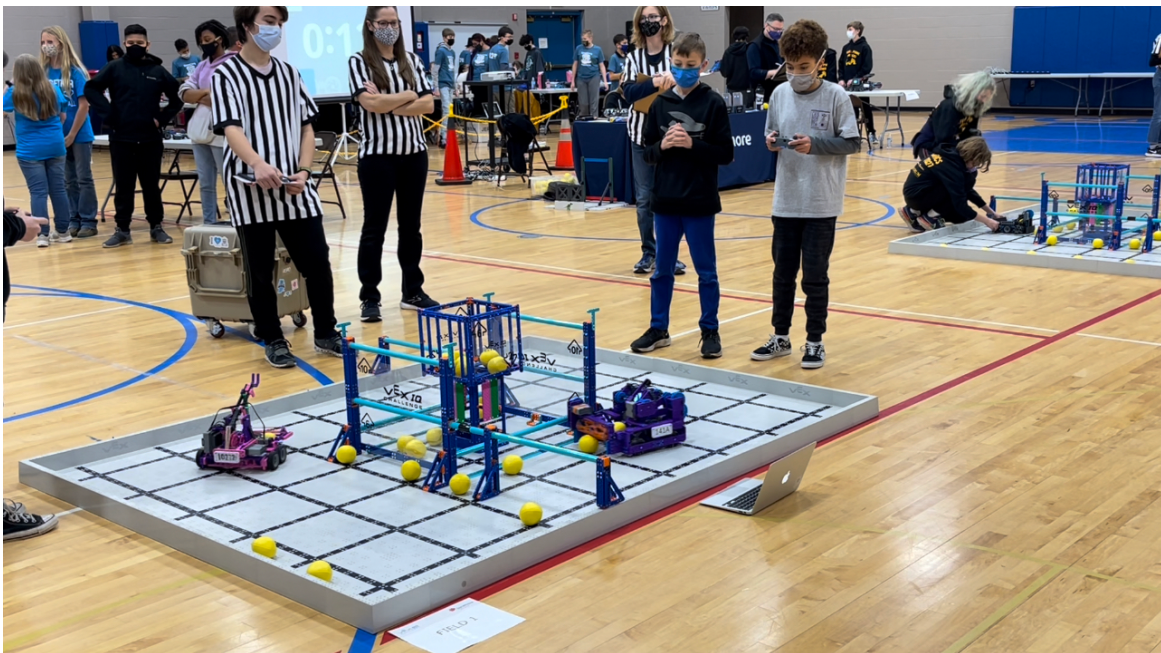
10. **TEST** – Does the Solution Work?

*We make notes about what works and what does not.*

11. **ITERATE**

*We refine. Each iteration of the robot brings us closer to solving the problem and fulfilling our goals. Each refinement is recorded.*

The engineering notebook is crucial, tying each step together and providing a detailed history of the robot's evolution. Should we ever become lost in the process, we can retrace our steps with the notebook's help and get "back on track."

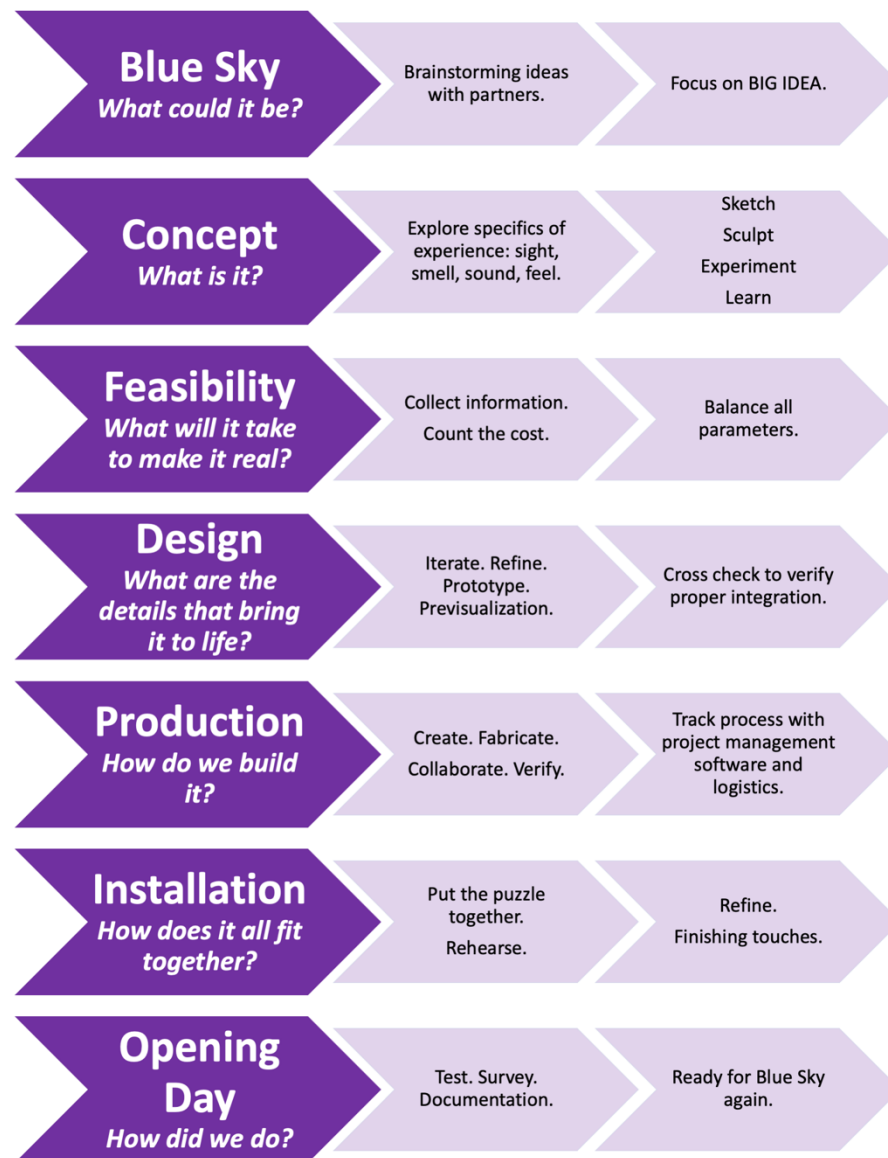


**Team 141A, Leo, Indiana**  
*Competing in Indianapolis, November 20, 2022*

## Disney Imagineering Design Process

The design process now affects the way I see the world. When I visited Walt Disney World in 2019, I noticed how rides were designed to appeal to visitors' senses. Queues incorporated a storyline. The skyline was uncluttered and hid the outside world. Music and the smell of food filled the air. Trashcans blended into the scenery. Not only did I enjoy the park's entertainment and rides, but I also admired its engineering design.

Disney Imagineers work behind the scenes to create the theme parks (and movies) we love. Some are artists, animators, or electrical engineers. Others are designers, architects, or builders. And like robotics students, Disney Imagineers follow a process very similar to the VEX robotics design process.



**Disney Imagineering Design Process**  
(<https://sites.disney.com/waltdisneyimagineering/our-proess>)

## A Comparison of Disney Imagineering and VEX Robotics Design Processes

Whether solving a problem or selling a product, every Disney Imagineering design has a purpose. Disney's **Blue Sky** is much like our team's **understand** step. We're solving a problem; we are figuring out the **big idea** of the robot. Along the way, our team must **explore**, a step that involves collecting resources. Background information is key. Imagineers must also conduct research, like learning what rides visitors would like.

The **feasibility** step for Imagineers is exactly what our team does when we **define** the specifics of our solution or project. We are asking what Imagineers ask: *What will it take to make it real?* The Imagineers for Disney's Tower of Terror were instructed to design the ride to (1) be like an elevator, (2) open to the outside from within, and (3) be a real hotel where people could stay (Prosperi). Our robot had to drive around a board, collect and move balls, catapult them into a box, and hang on a bar.



*The Tower of Terror Concept Picture*  
<https://insidethemagic.net/2021/03/tower-of-terror-drop-rwb1/>

Brainstorming and networking with experts is essential to the engineering design process, whether it is called **ideate** (robotics) or **blue sky** (Disney). Ideas are what feed the **design** and **production** phases.

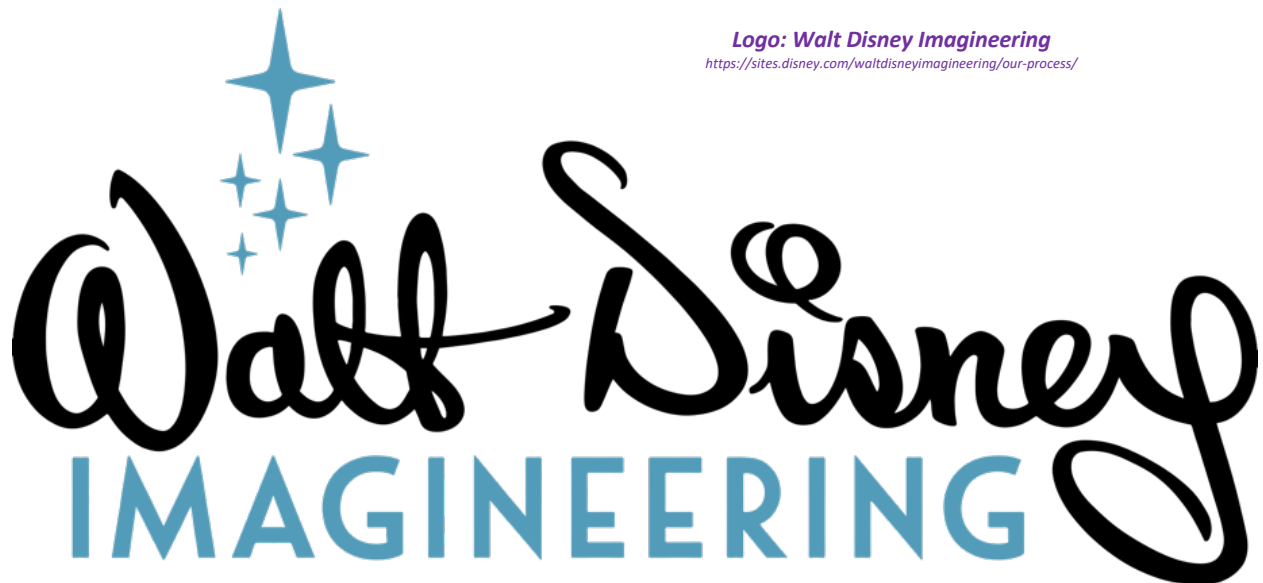
Engineers who design a park or build a robot must understand the **requirements** and **constraints** of the idea: *How do we build it? What components are needed?* Imagineers and robotics students must also **prototype**, **test**, and **choose** their designs. While these steps may be given different names, the process is the same. The **prototyping** step is all about learning what will work, leading students and Imagineers to choose their final design.

**Refinement** is also necessary for both robotics students and Imagineers. We test the robot repeatedly, making careful **adjustments** until it operates perfectly. Imagineers test rides, walk through lines, check sightlines at different times of the day, carefully evaluating and refining the experience. Disney experiences appeal to every sense – sight, smell, taste, sound, feel – and require **iteration** and **refinement**.

**Opening day** for the Disney Imagineer combines all the same elements as steps eight through eleven for the robotics student. Revealing the new ride is much like taking the robot to competition and having the judge give feedback. In either case, this presentation is the culmination of the design process.

## My Plan

I want to apply what I've learned as a VEX robotics student to a career in Imagineering with Disney. Imagineering brings art, music, design, and engineering together to create an experience that appeals to all ages and engages all the senses. The same engineering design process that has helped my team and me build robots and compete against teams from all over the world is what Imagineers use to create timeless entertainment experiences for people all around the world.



*Logo: Walt Disney Imagineering*  
<https://sites.disney.com/waltdisneyimagineering/our-process/>



#### Sources Cited:

VEX Curriculum. 2002-2015. <https://curriculum.vexrobotics.com/curriculum/intro-to-engineering/what-is-the-engineering-design-process.html>

Prosperi, Louis. 2018. *The Imagineering Process: Using the Disney Theme Park Design Process to Bring Your Creative Ideas to Life*.

Walt Disney Imagineering. 2022. <https://sites.disney.com/waltdisneyimagineering/our-process/>