



Invention Project

PowerPoint Lesson Slides
Created by Michael Bryson

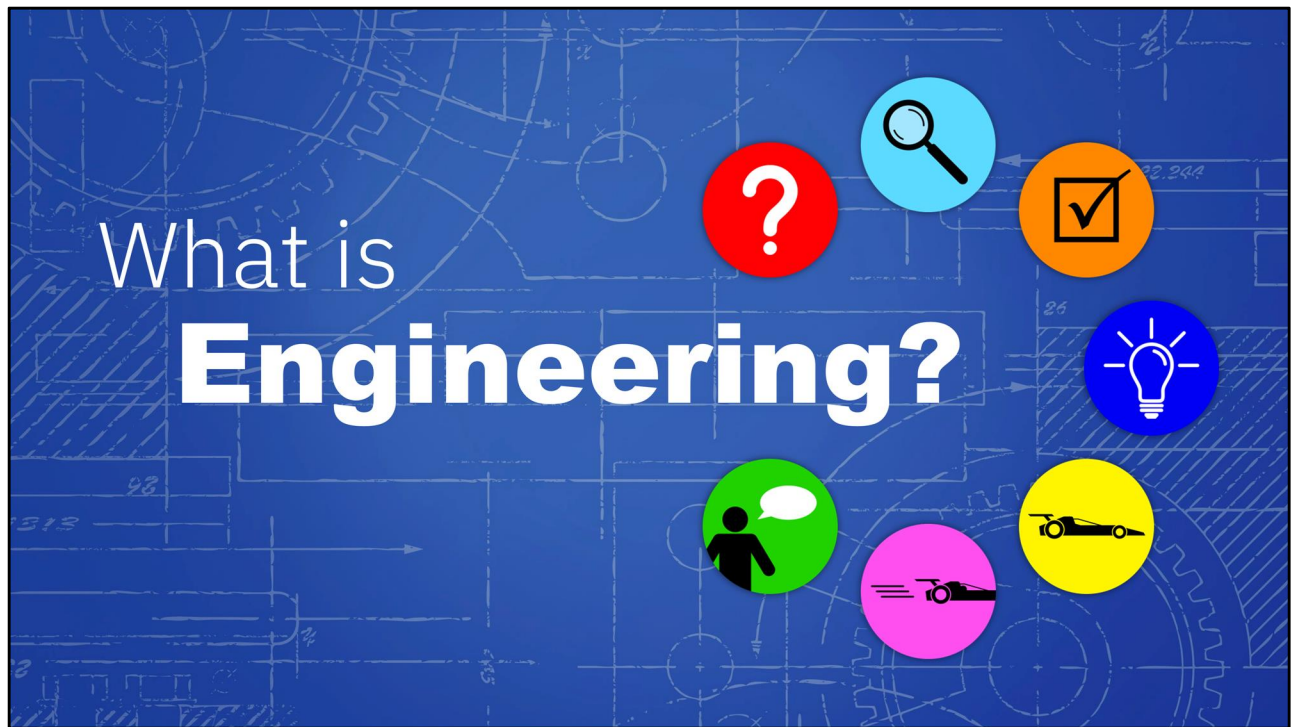
www.andrews.edu/go/invent

Andrews University STEM Division
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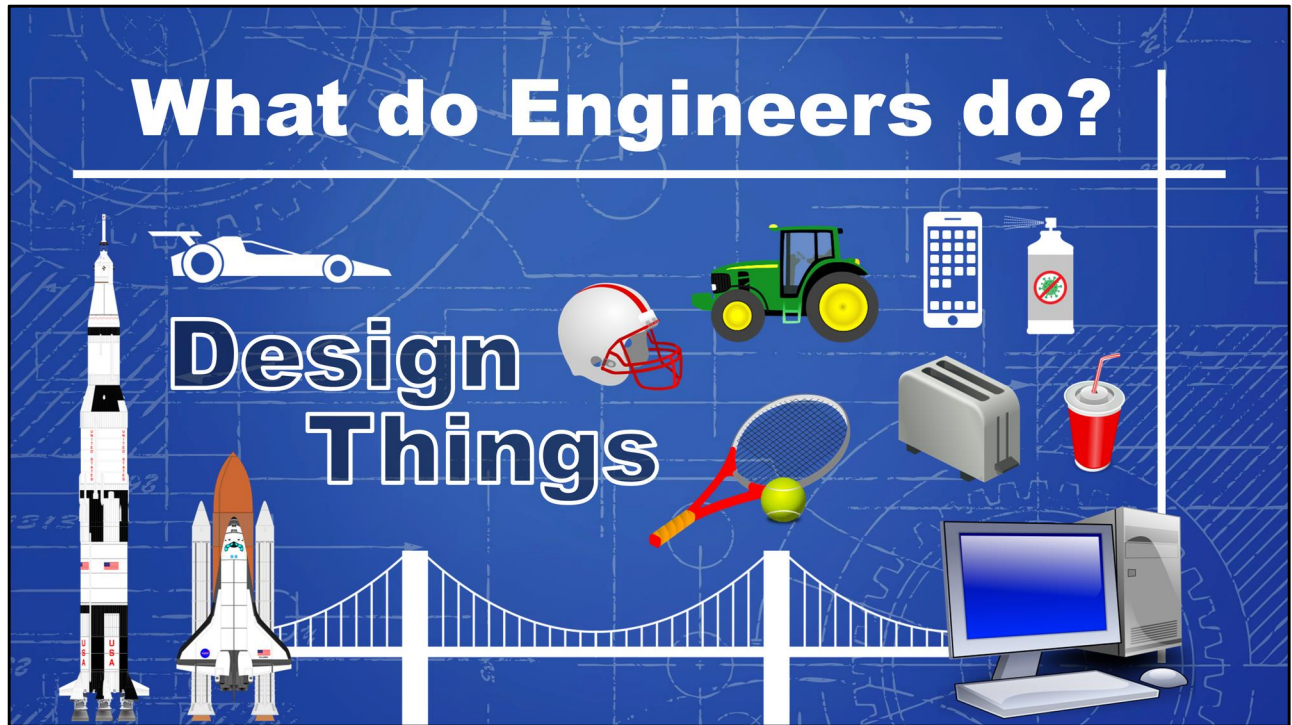
Note:

Some slides in the PowerPoint have text or images that appear out of place until full-screen playback. This is because some elements are animated and will not appear in the right place until the slide is played. There are also some animated transitions that require an extra slide to animate properly. These slides were simplified for the notes version to improve readability.

Page numbers in this document do not correspond to slide numbers in the PowerPoint.



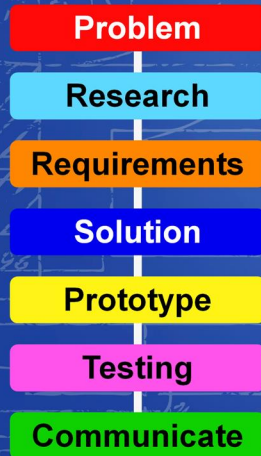
Lesson 3: What Is Engineering?



What do Engineers do?

Engineers design things to solve problems – computers, bridges, rockets, toasters, drink cups, and more.

Engineering Design Process



How do engineers solve problems?

They follow the engineering design process. These systematic steps allow them to design solutions to real-world problems.

This process will help students create an invention to solve their team's problem.

Briefly explain each step (next slide)

Engineering Design Process

Problem

Research

Requirements

Solution

Prototype

Testing

Communicate

Step 1: Problem

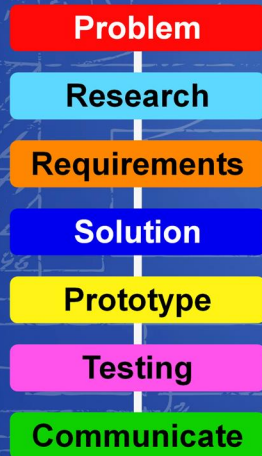
Observe the problems around you and choose one to solve. Then define the important aspects of the problem.

?

Step 1: Problem

Find a problem by observing the world around you.
Define (describe) the problem in detail.

Engineering Design Process



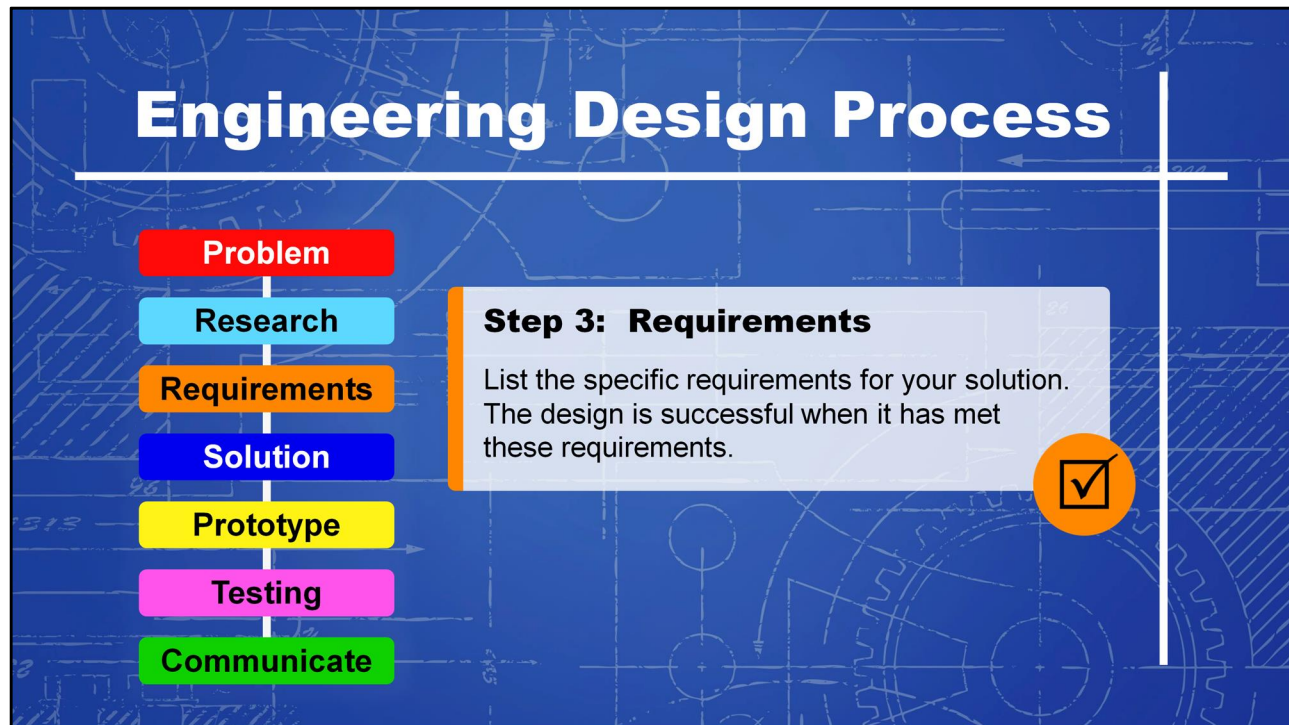
Step 2: Research

Research who/what is affected by the problem, existing solutions/inventions, and areas for improvement.



Step 2: Research

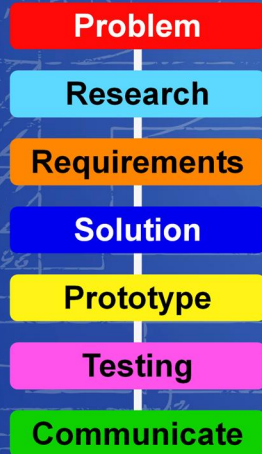
Learn more about the problem and other potential solutions.



Step 3: Requirements

List the requirements for your solution, but don't choose a solution yet. These are the things you will have to address to solve the problem.

Engineering Design Process



Step 4: Solution

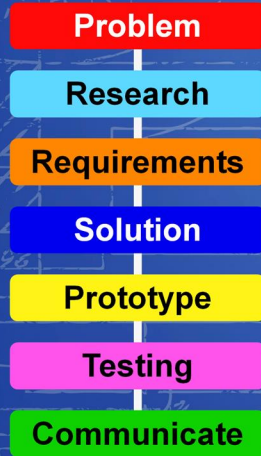
Brainstorm and discuss to find original ideas.
Compare with the requirements to choose the best solution.



Step 4: Solution

Consider any and all possible solutions. Compare these solutions to the requirements and pick the one with the best chance of success.

Engineering Design Process



Step 5: Prototype

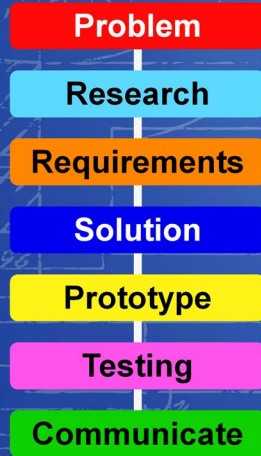
Design how your invention will work and what it will look like. Then follow the design and build it.



Step 5: Prototype

Design and build a prototype (model) of the solution you chose.

Engineering Design Process

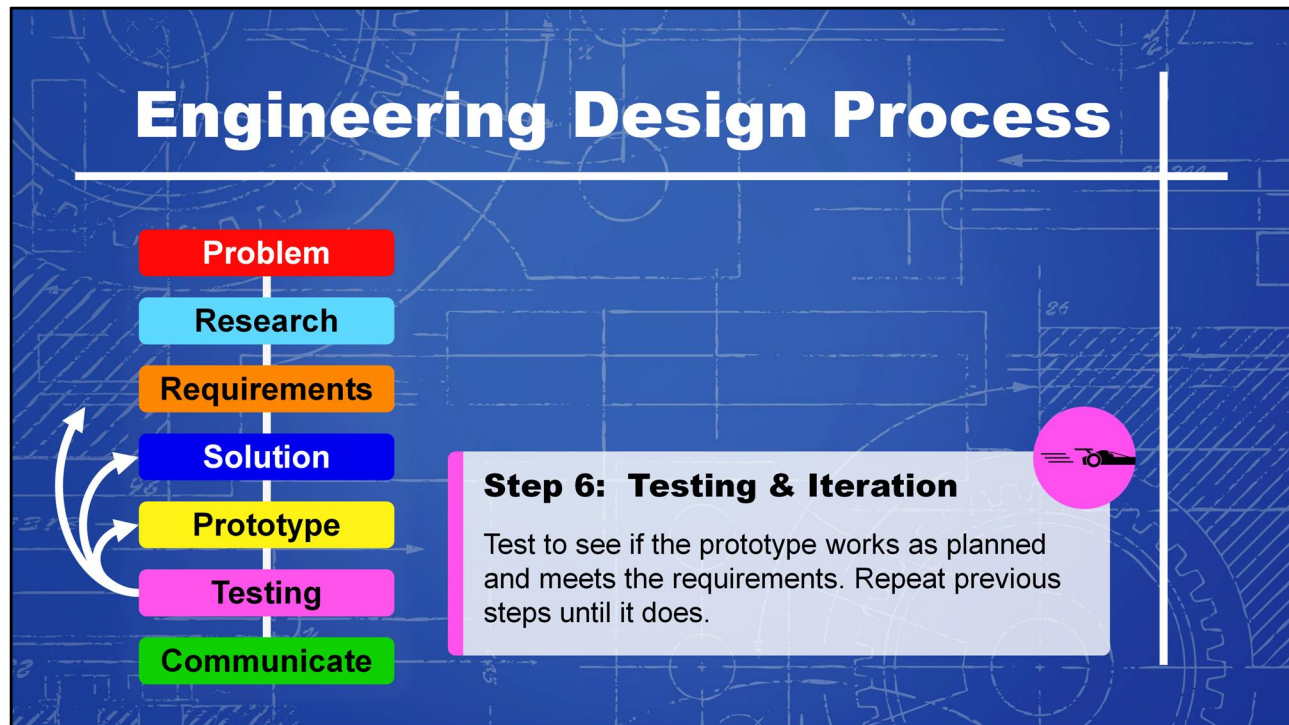


Step 6: Testing

Test to see if the prototype works as planned and meets the requirements.

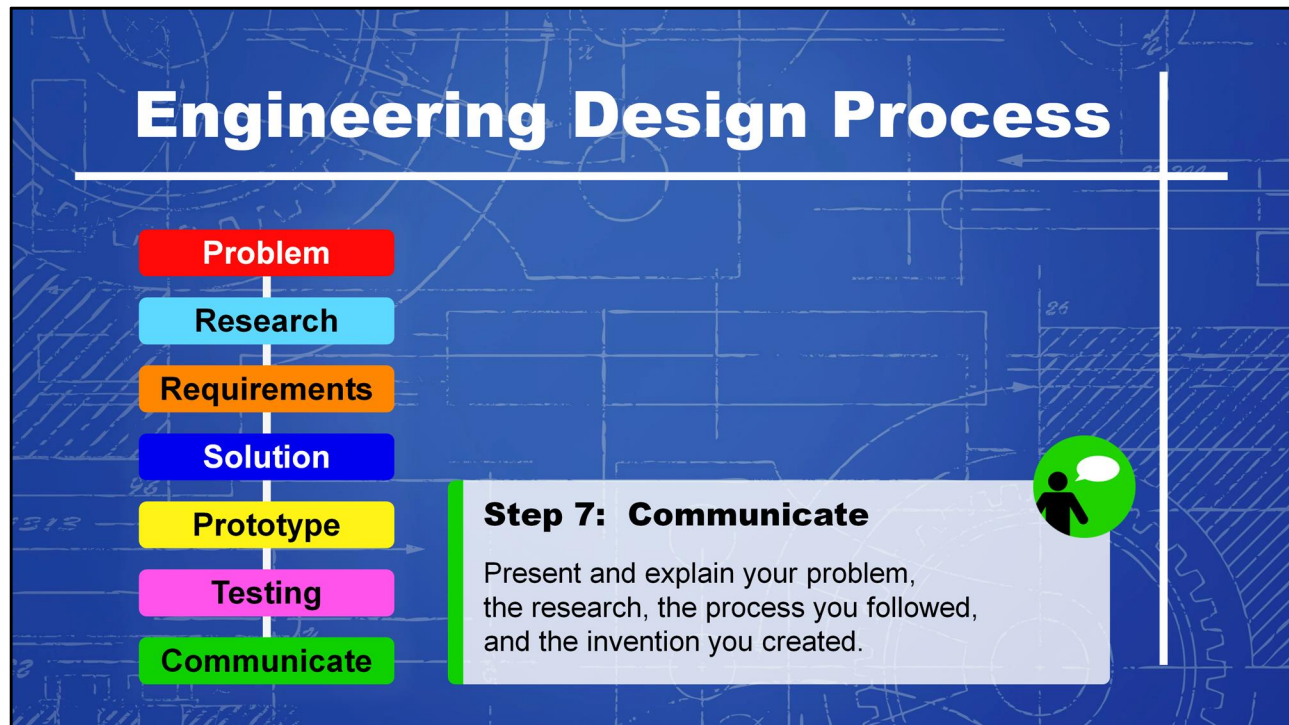
Step 6: Testing

Test the prototype to see how well it works.



Step 6: Testing (& Iteration)

Test the prototype to see how well it works. Return to previous steps and make improvements as necessary (iteration).



Step 7: Communicate

Tell others what you accomplished. Show them the final result and explain the steps you took.

Example Problem

Problem

Find a Problem:

- Choose a simple problem to practice solving as a class.

Example Problem:

This activity should be completed together as a class. Let the students think for themselves and discuss together as you guide the process. This is an opportunity for them to practice the engineering design process before doing it with their own problem. You will not be doing the entire design process with this example (only the first 4 steps). As you progress through the example, write and draw on the board.

Find a Problem:

- Choose a simple example to solve with the class.
- You can find Example Problems on our website (Activities section in Teacher Resources) or choose your own.
https://www.andrews.edu/cas/stem/invent/downloads/example-problems_6-8.pdf

Example Problem

Problem

Define the Problem:

- List the important aspects of the problem.
- Imagine you are describing the problem to someone who knows nothing about it. Tell them everything!

Define the Problem:

- Describe the problem in detail.
- List anything that might be important to know when looking for a solution.

Example Problem



Research

Research the Problem:

- Who or what is affected by this problem?
- Are there existing solutions or inventions?
- Are there things you can improve?

Research the Problem:

- Consider the questions for the chosen problem.
- To save time, this step can be simplified or skipped for the example.
- Students will go more in depth when doing it for their own problem.

Example Problem

Requirements

List Solution Requirements:

- Criteria & Constraints
- Safety, size, weight, strength, time, cost, etc.
- Be specific
- Don't choose a solution yet.

List Solution Requirements:

Write the requirements on the board.

- Criteria – things the solution must meet or do
- Constraints – things the solution must not do (limitations or restrictions for the design)
- Consider the requirements for the solution without choosing a specific solution yet.
- The requirements will be the checklist for the invention.

Example Problem

Find Solutions:

- Brainstorm as many ideas as possible.
- Write or draw every idea.
- There are no bad ideas!

Solution

Find Solutions:

Write/draw the solutions on the board.

- Let students think of and draw solutions on their own or in groups.
- Have the students share with the class.
- Think of as many ideas as possible.
- Even bad ideas may spark an idea in someone else.
- Consider solutions you can make.

Example Problem

Choose the Best Solution:

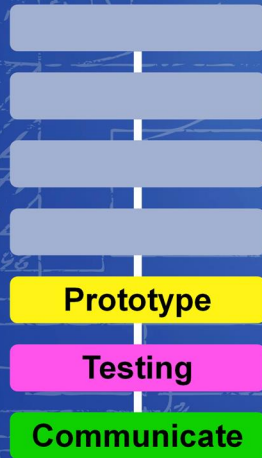
Solution

- Share, discuss, compare, and revise ideas.
- Does the solution meet the requirements?
- Is it original or innovative?

Choose the Best Solution:

- Discuss as a class or in small groups.
- Choose the solution that best meets the requirements.
- The solution should be original or innovative (improve on existing inventions).

Example Problem



Remaining Steps:

- Design and build a prototype.
- Test the prototype and make improvements.
- Show and tell others.

Remaining Steps:

- When students do this with their own project, they will then design, build, test, and improve their solution.
- At the end, they will prepare a presentation.

Next Class

Collaborate with your team to...

- Define the problem
- Research the problem

Starting next time, the students will work on the project in their teams. They will follow the engineering design process and document their progress in the Logbook (available on our website, Project Resources section in Teacher Resources).

Invention --- Project

