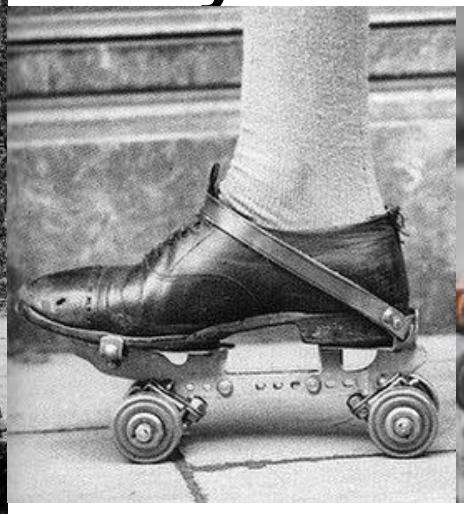
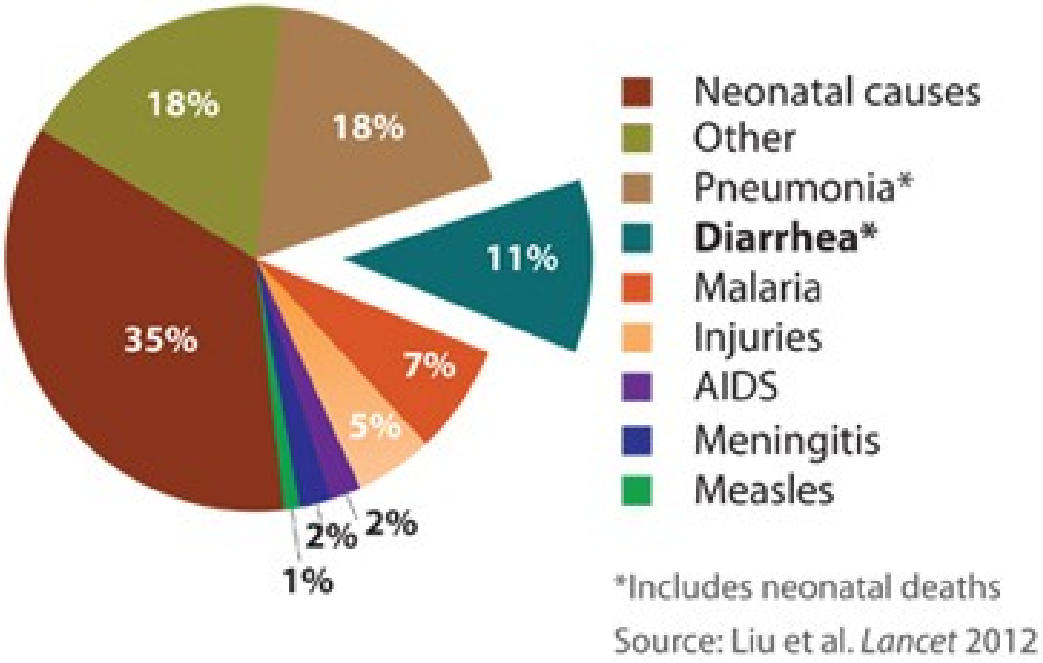
AIM: • How is the engineering process used?

Pre

DO NOW: • Think of an object that you use in your everyday life. How do you think it has changed over time? Why was it changed?

Facts:



- **Diarrhea kills 2,195 children every day —more than AIDS, malaria, and measles combined [1].**

  Diarrheal diseases account for 1 in 9 child deaths worldwide, making diarrhea the second leading cause of death among children under the age of 5.

- More than 2 billion people around the world lack access to a decent toilet. Their waste often ends up in the environment, untreated, killing nearly 800 children every day.

- https://www.scmp.com/video/china/2172064/bill-gates-shows-us-toilet-future

AIM:
- How can we explain the engineering process?

DO NOW:

- What do engineers do?
- Why do you think so many schools want to have STEM or STEAM (Science, Technology, Engineering, Arts, Math) courses?

Engineering Design Process

- A series of steps that engineers use to guide them as they solve problems.
- It is a cycle and can begin at any step, or move back and forth between steps. (1)

(1) www.ecybermission.com

Engineer

- A person trained and skilled in the design, construction, and use of a system or machine.

Engineering Fields	
Mechanical	Aerospace
Electrical	Nuclear
Chemical	Civil
Biomedical	Computer

Innovation vs. Invention

Invention

A device or process *originated* after study and experiment

→

Innovation

A new improvement to an *existing* device or process

Image taken from:
http://www.novuslight.com/led-market-phasing-in_N239.html

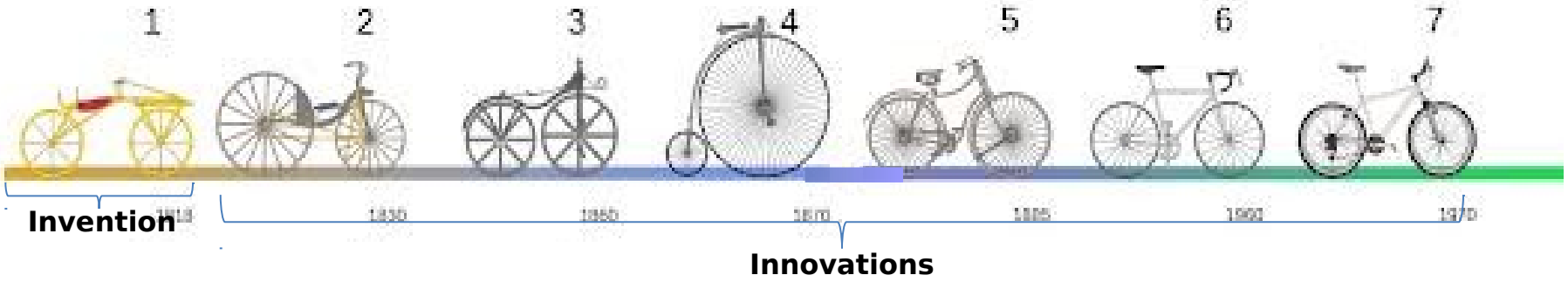


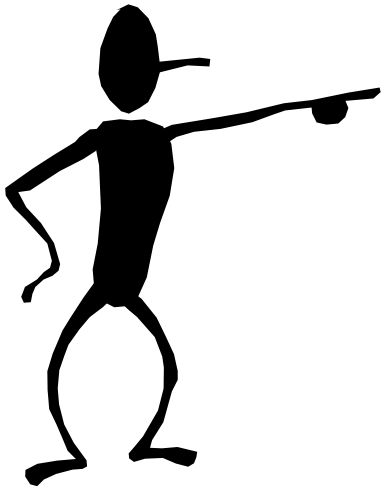
Image taken from:
http://lexpower.wordpress.com/2010/07/21/chronological-order-show-me-the-timeline/1000px-bicycle_evolution-en-s

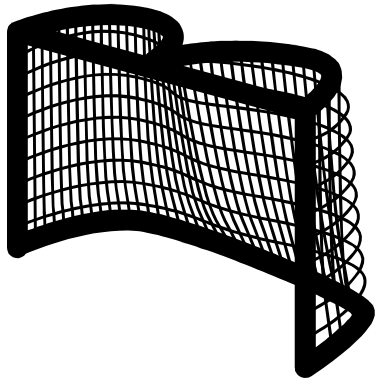
Engineering Design Process

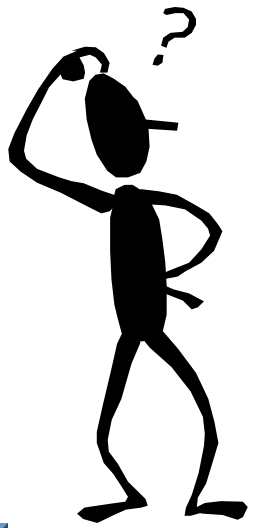
Click on a “slice” of the Engineering Design Process cycle to learn more about its parts

Identify problem and goal

- Identify and describe the issue and the objective







- Consider:
  - What do you want to accomplish?
  - What are the requirements?
  - Are there any limitations?
  - Who is the customer?

Research

- What solutions already exist?
- Talk to individuals who share this problem and could benefit from possible solutions

Image taken from:
http://walrus.wr.usgs.gov/infobank/programs/html/facilities/us.archives.html

Imagine possible solutions

- Brainstorm ideas.
- Be creative and build upon the ideas of others – **during this step there are no bad ideas.**
- Explore and compare many possible designs within your group.
- Be open-minded!

Image taken from:
http://www.vinylrecords.ch/J/JO/John/John_Lennon/imagine-capitol/john-lennon-imagine.html

Choose a solution

- What materials and tools are needed?
- Consider environmental, cultural, time, and financial issues and constraints.
- Select the **most feasible** idea and **assign team tasks**.

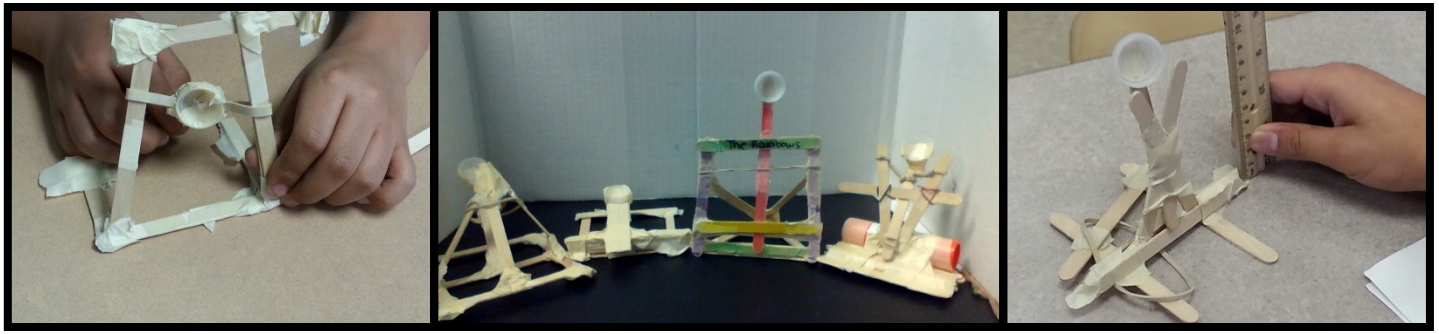
http://chelseag y-moe.html

Image taken from:
http://andrewmatre.com/how-colors-help-make-websites-successful/

Create & test prototype

- Build a **protoype**
  - Protoype - an operating version of a solution. It is often made with different materials (cheaper and easier to work with) than the final version. They allow you to test your solution and supply feedback. [2]
- Push yourself and the group for creativity, imagination, and excellence in design.

*****Record data while testing your prototype



[2]http://www.sciencebuddies.org/engineering-design-process/engineering-design-prototypes.shtml

Redesign / Improve

- **Iterate** your design to make the product the best it can be.
  - *Iterate - to repeat an already completed task to incorporate new information* [3]

Image taken from: http://www.rubymarketer.com/improve-search-engine-ranking/

[3] Ulrich K., Eppinger S. 2000. Product Design and Development. 2nd Edition. Irwin McGraw-Hill, Boston.

Share your results

- Share results and continue to seek how your team could make the solution better.
- Accept feedback from others and use it for further improvements.

AIM:

- How can we define a problem and conduct research that will help us find a solution?

DO NOW:

- What does a rocket do?
- What forces affect a rocket?

Defining our problem

Criteria:

- Goal is to hit a target range with a rocket that is powered by alka seltzer.
- You can construct the body out of any paper materials – any type of paper.
- You can change the body length and shape, the nosecone, the fins.

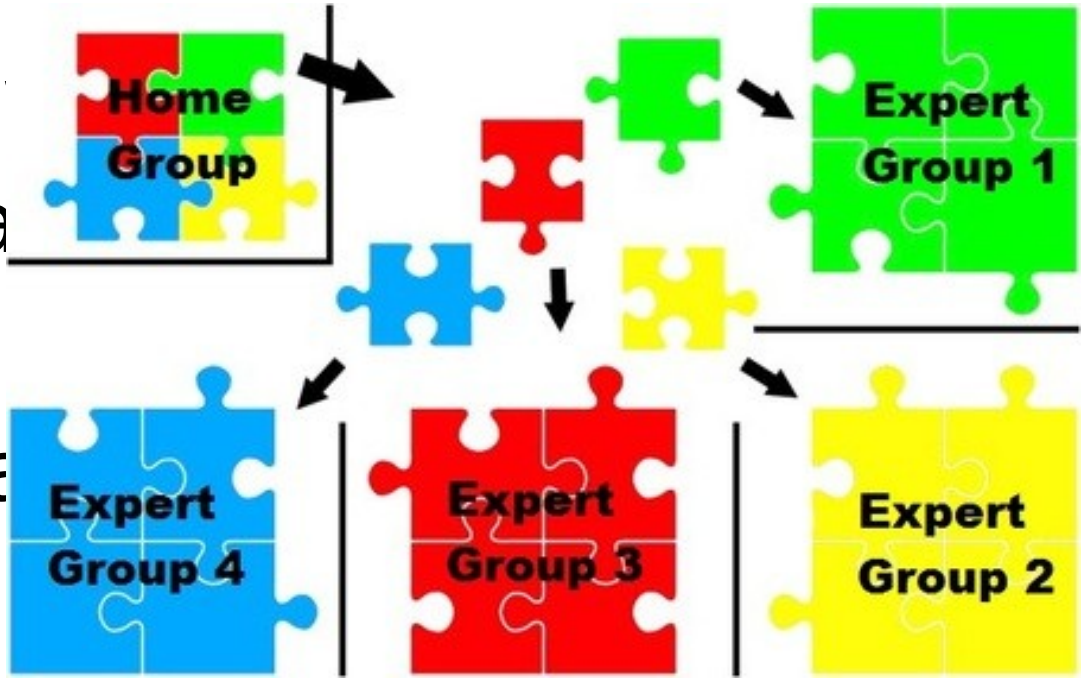
Questions to answer:

- What is the goal distance?
- How will we launch it?
- What angle should we launch it?

Research

Jigsaw:

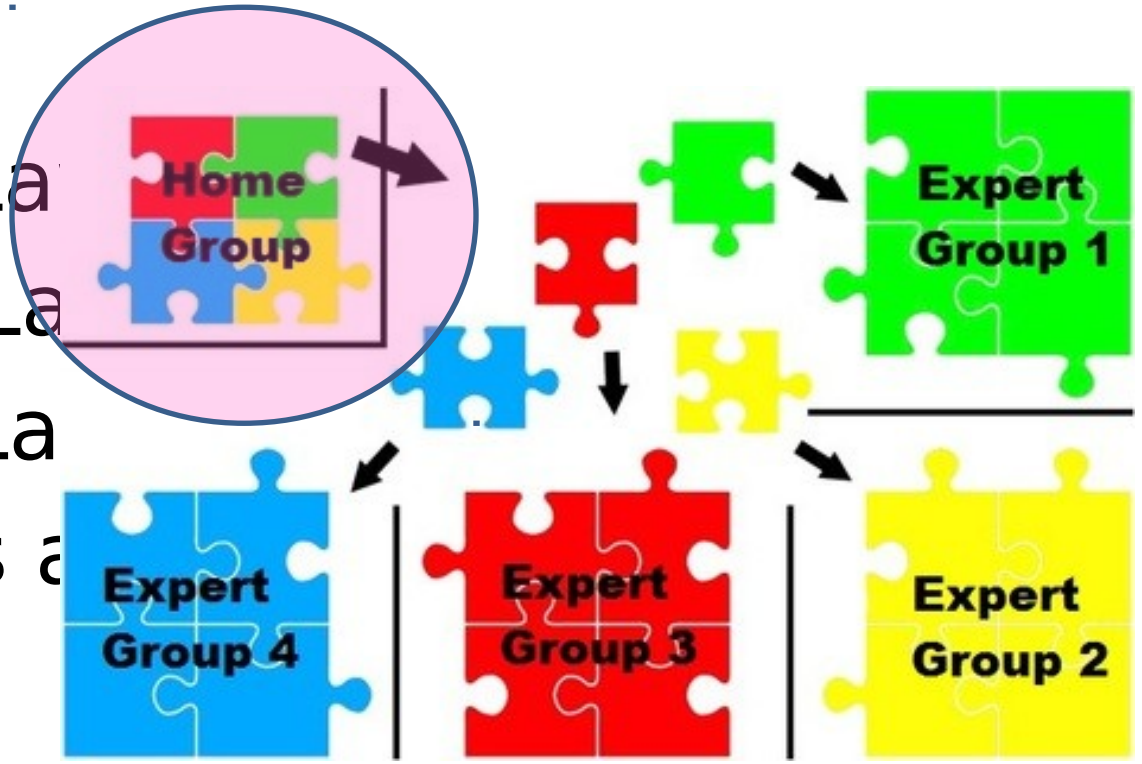
1. Newton's 1st La
2. Newton's 2nd La
3. Newton's 3rd La
4. Aerodynamics a
   air resistance.



Share your Research

Jigsaw:

1. Newton's 1st La
2. Newton's 2nd La
3. Newton's 3rd La
4. Aerodynamics a
   air resistance.



AIM:

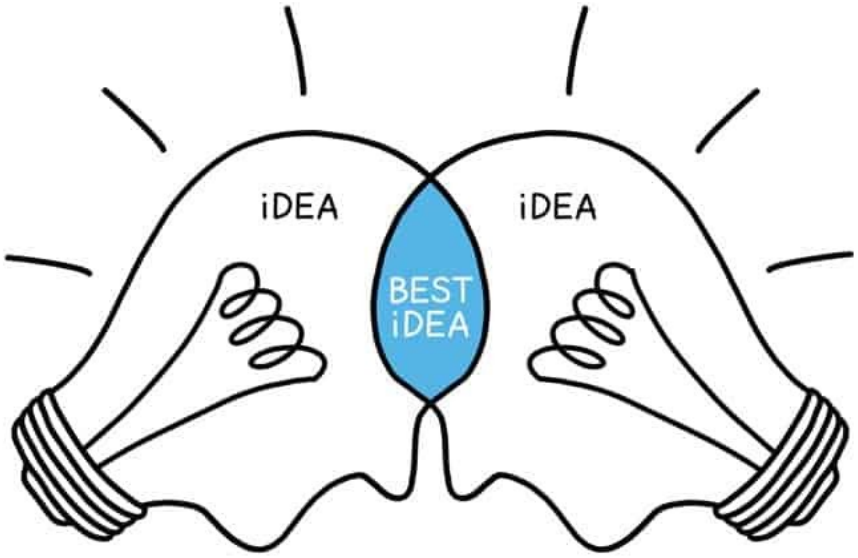
- How can we design and evaluate possible solutions to a problem?

DO NOW:

- Take out your research.
- Based on your responses, what is one thing your rocket will need? Explain your answer.

Design Brainstorm

- Sketch ideas for your model, 1 idea per post it.
- Get as many ideas as you can…do not judge ideas at this stage.
- Label important details: number of fins, general size, specific materials.



Evaluate Ideas (In Engineer's notebook)

-	+
	From the ideas you like, pick the best design you think will meet the goal. This is the rocket you will build. **

AIM:

- How can we build an accurate prototype/model?

DO NOW:

- Look at your designed rocket.
- What are 3 tasks that need to be completed while building this rocket?

Building our Prototype

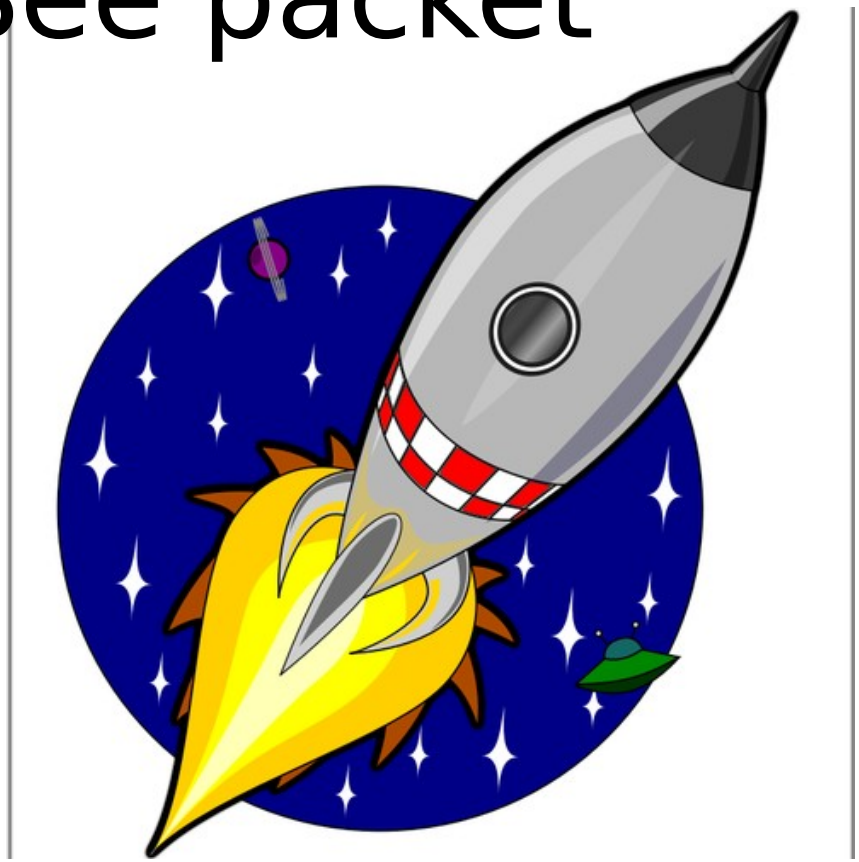
- Make a list of the tasks to complete IN ORDER.
- Assign each task by writing a team member’s name next to it.
- Build your prototype
- Check off each task as you complete it.
- Include measurements in your notebook (how long is the body? What are the measurements of the fins? How many fins?

AIM:

- How can we test our prototype to evaluate our solution to a problem?

DO NOW:

- See packet



Prelaunch discussion

- Meet with your Mission Team and trade rockets – write 3 comparisons between your and their rocket.
- Who’s do you think will meet the goal?

Launching Procedure

- Mission teams launch together.
- Reach, short or past goal? How far?

- Return to classroom and answer post launch questions with your group.

AIM:

- How can we evaluate our data to improve our prototype/model?

DO NOW:

- Was your launch successful?
- Why or why not?
- What do you consider to be success in this task?

- DO NOT start over.
- Look at data to make changes to your design.
- Be specific.
- Example: The rocket did not reach the target range.

  Possible cause – there is too much mass.

  Redesign – reduce mass by reducing the length of the rocket.

Redesign

The Launch

- What to consider:
  - The launch pad **
    What forces do we need to overcome during the launch?
  - The film container
  - The alka seltzer
  - The water – what is the optimal temperature?

The Rocket

- What forces affected our rocket?
- What physical characteristics of the rocket made it successful / unsuccessful?
- How do we need to change those characteristics?
- Include diagram if you have time.

Mission Team Pair Up

FIRST

Group 1

- Share your redesign
- Use feedback to modify your work.

Group 2

- Give feedback

THEN…

- Give feedback

- Share your redesign
- Use feedback to modify your work.