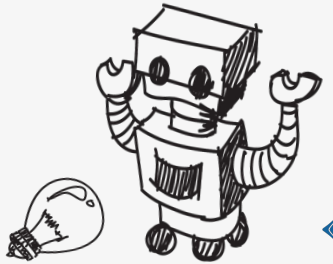
Powered by IEEE

TRY Engineering

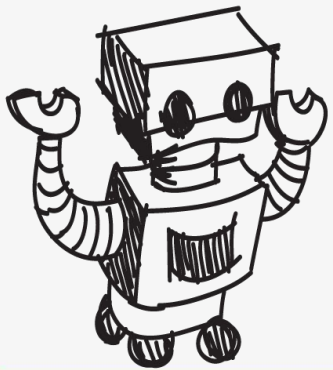
Lesson Plan:

Playing with Parachutes



IEEE

The Design Challenge



The Design Challenge

- You are a team of engineers who have been given the challenge to design a parachute out of everyday items. Your challenge is to design a parachute that can carry one metal washer to the ground from a height of 2 meters and hit a 10 centimeter round target with the slowest possible rate of descent.

Defining the Challenge: Criteria & Constraints

Criteria

- Must carry one metal washer to the ground from a height of 2 meters and hit a 10 centimeter target with the slowest possible rate of descent.

Constraints

- Use only the materials provided
- Teams may trade unlimited materials.

Material

Required for Build (Trading/Table of Possibilities)

- Ball of string
- Plastic trash bags
- Plastic shopping bags
- Sheets of paper
- Coffee filters
- Newspapers
- Aluminum foil
- Metal washers (3cm diameter)

Testing Material and Process

Testing Material

- Meter stick or tape
- Small ladder
- String/tape
- Paper plate

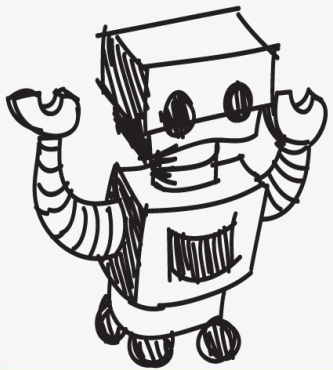
Testing Process

Make a 10cm round target on the floor with tape, string or you can use a paper plate. Use a small ladder to drop the parachutes from a height of 2 meters. The drop height should be measured from the bottom edge of the washer (hanging from the parachute).

Consider...

Before you get started brainstorming, consider discussing how a parachute works and consider what is unique about the design.

Reflect & Debrief



Reflection

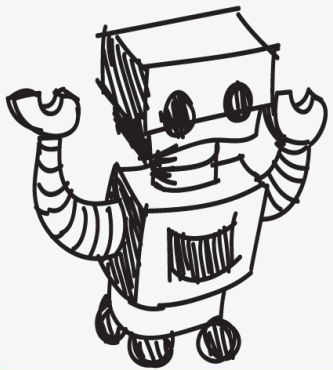
- Did you succeed in creating a parachute that could hit the target? If so, what was your slowest rate of descent? If not, why did it fail?
- Did you decide to revise your original design or request additional materials while in the construction phase? Why?
- Did you negotiate any material trades with other teams? How did that process work for you?
- If you could have had access to materials that were different than those provided, what would your team have requested? Why?
- Do you think that engineers have to adapt their original plans during the construction of systems or products? Why might they?

continued on next page

Reflection

- If you had to do it all over again, how would your planned design change? Why?
- What designs or methods did you see other teams try that you thought worked well?
- Do you think you would have been able to complete this project easier if you were working alone? Explain…
- What kind of changes do you think you would need to make to your design if you needed to transport a heavier payload? Try it!

Engineering Design Process



The Engineering Design Process

Learn about the engineering design process (EDP). The process engineers use to solve problems.

(Video 1:47)

Source: TeachEngineering YouTube Channel http://www.youtube.com/watch?v=b0ISWaNoz-c

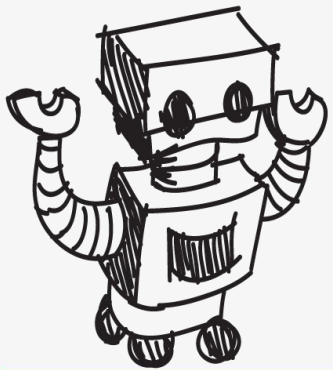
Engineering Design Process

- Divide into teams of two (or up to 4 max)
- Review the challenge and criteria & constraints
- Brainstorm possible solutions (sketch while you brainstorm!)
- Choose best solution and build a prototype
- Test then redesign until solution is optimized
- Reflect as a team and debrief as a class

Productive Failure

- The engineering design process involves productive failure: test, fail, redesign. Iterate again and again until you have the best possible solution.
- It is important to document iterations to keep track of each redesign. Use the engineering notebook to sketch ideas, document iterations and any measurement and/or calculations.
- It’s also important to showcase the fact that there can be multiple solutions to the same problem. There’s no one “right” solution.

Vocabulary



Vocabulary

- Canopy: Upper portion of the parachute.
- Constraints: Limitations with material, time, size of team, etc.
- Criteria: Conditions that the design must satisfy like its overall size, etc.
- Descent: The act or process of going downward
- Engineers: Inventors and problem-solvers of the world. Twenty-five major specialties are recognized in engineering (see infographic).
- Engineering Design Process: Process engineers use to solve problems.
- Engineering Habits of Mind (EHM): Six unique ways that engineers think.

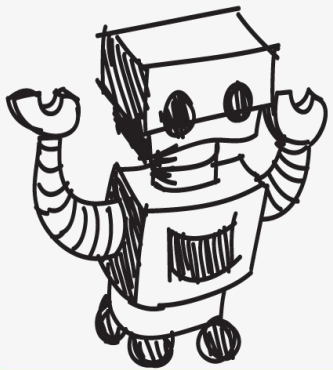
Vocabulary

- Iteration: Test & redesign is one iteration. Repeat (multiple iterations).
- Parachutes: Devices used to slow the movement of objects. Parachutes are typically used to slow the movement of falling objects but they can also be used to slow down horizontally moving objects such as race cars.
- Payload: Weight carried by a vehicle, aircraft or spacecraft.
- Prototype: A working model of the solution to be tested.
- Ram-air parachute: Most of the parachutes which are intended for use by people that we see today are ram-air parachutes. The canopy in a ram type parachute is made up of 2 layers of material which are sewn together to form air filled cells.

Vocabulary

- Ribbon and ring parachute: Used at supersonic speeds.
- Round parachute: The parachute most people are familiar with is the round parachute. The round parachute is characterized by a circular canopy.
- Square parachute: The square or cruciform parachute possesses a squarish shaped canopy. Square parachutes are beneficial because they reduce jostling of the user and have a slower rate of descent; reducing injuries.

Dig Deeper



Dig Deeper into the Topic

Internet Connections

- NOVA – Design a Parachute (http://www.pbs.org/wgbh/nova/mars/parachute.html)
- History of the Parachute (https://www.thoughtco.com/history-of-the-parachute1992334)

Recommended Reading

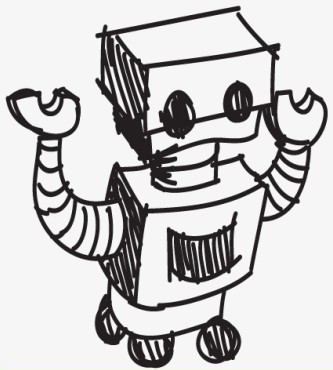
- The Silken Canopy: History of the Parachute (ISBN: 978-1853108556)
- Sky People : A History of Parachuting (ISBN: 978-1853108693)

Dig Deeper into the Topic

Writing Activity

Research Leonardo DaVinci's conical parachute and compare and contrast it with modern parachute designs.

Engineering Fields



What is Engineering?

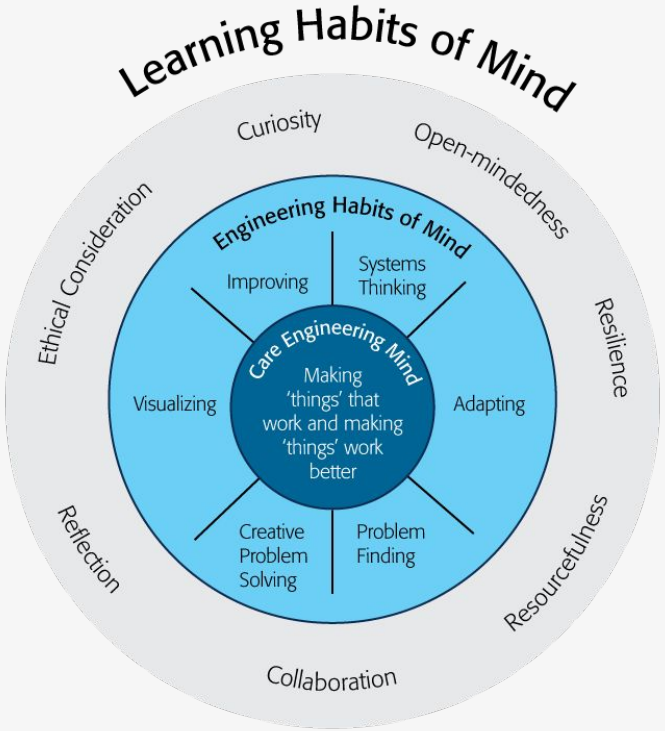
Learn about engineering and how engineers are creative problem solvers and innovators who work to make the world a better place.
(Video 3:43)

Source: TeachEngineering YouTube Channel - http://www.youtube.com/watch?v=H9VDkvqGmVo

Related Engineering Fields

- There are several types of engineering fields that are involved with designing parachutes and other lifesaving devices. Here are just some of the related engineering fields.
  - Materials Engineering
- Download the Engineering Fields Infographic How will **YOU** change the world?

Engineering Habits of Mind



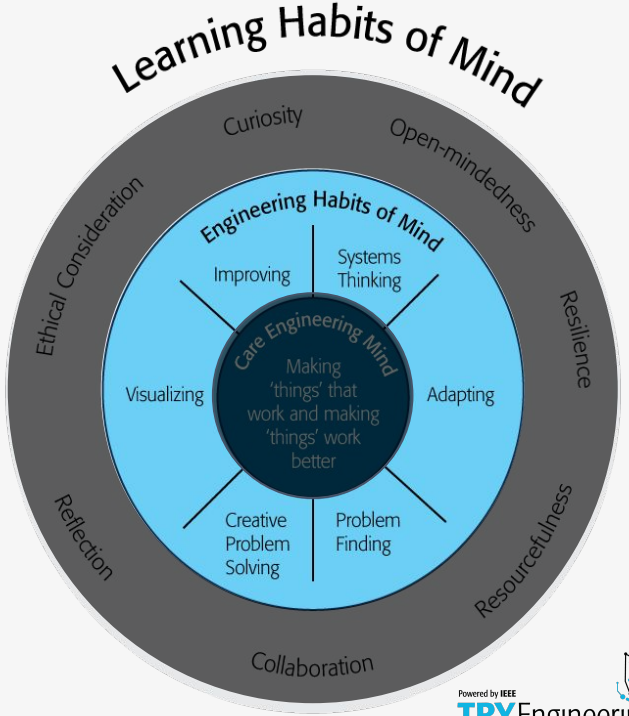
Engineering Habits of Mind (EHM) is about how engineers think everyday. The Core Engineering Mind is about making things that work and making them work better.

Source: https://online-journals.org/index.php/i-jep/article/view/5366)

Powered by IEEE TRYEngineering | IEEE

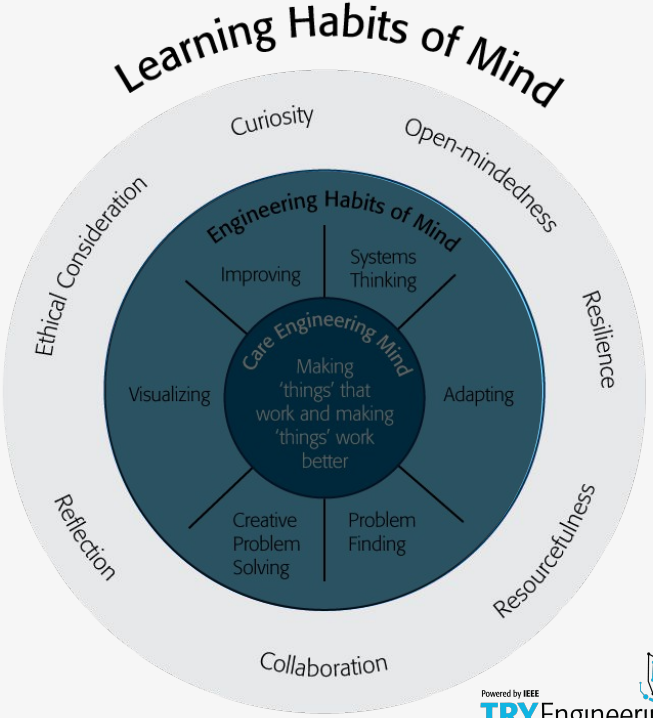
Engineering Habits of Mind Checklist

- ❑ **Systems thinking**
- ❑ **Problem-finding**
- ❑ **Visualising**
- ❑ **Improving**
- ❑ **Creative problem-solving**
- ❑ **Adapting**



Learning Habits of Mind Checklist

- Open-mindedness
- Resilience
- Resourcefulness
- Collaboration
- Reflection
- Ethical Consideration
- Curiosity

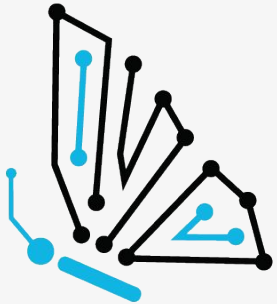


Greatest Engineering Achievements of the 20th Century

Source: http://www.greatachievements.org/

Learn more about how engineers make the world a better place

For more engineering lesson plans and resources like games, engineering careers, and STEM opportunities visit IEEE's TryEngineering.org



Powered by IEEE

TRY Engineering