Packing Up for the Moon

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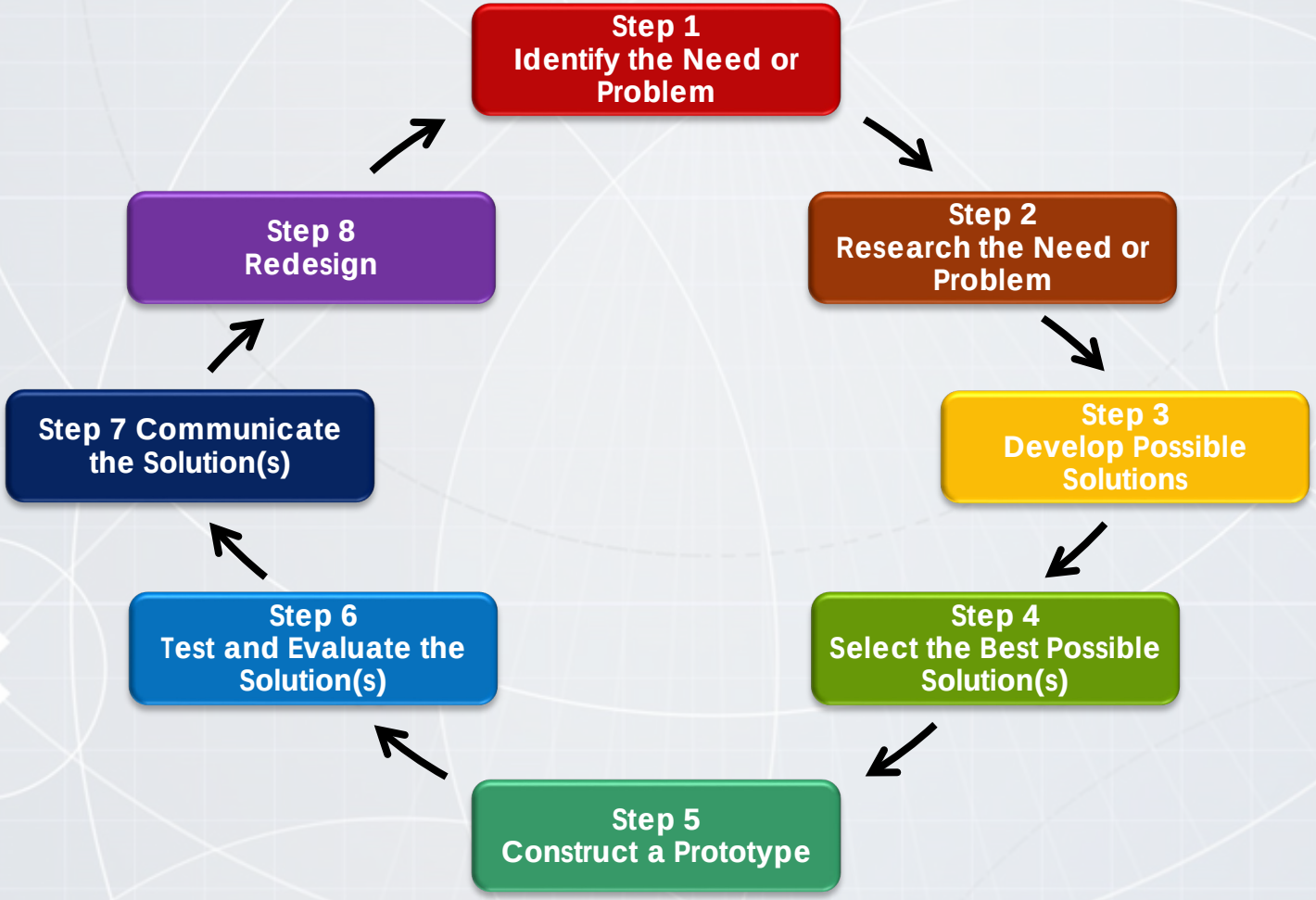
View the video at https://y4y.ed.gov/stemchallenge/nasa.

Engineering Design Process



Packing Up for the Moon

Before you begin the challenge, complete the **KNOW** sections of this chart, sharing prior knowledge and experiences.

The **LEARN** column is filled out as you find out information during the challenge research, including videos, articles, and discussions with a NASA subject matter expert.

The **EVIDENCE** section is where you record where you found information and what sources you used.

The **WONDER** section is where you list new questions you are wondering about as you complete research.

Know, Learn, Evidence, Wonder (KLEW) Chart

Know	Learn	Evidence	Wonder
What do I know about plants and plant growth chambers?	What did I learn about plants and plant growth chambers based on my research?	What evidence do I have that supports what I learned about plants and plant growth chambers?	What am I still wondering about plants and plant growth chambers?

The Challenge—Packing Up for the Moon

You and your team will have the task of engineering a tabletop model of a plant growth chamber that can be folded, stowed, and shipped on a rocket destined for the Moon. When the shipment arrives, the future lunar astronauts will then be able to expand the plant growth chamber and deploy it on the lunar surface. Because this project is in the development stage, the team will only need to design, build, and present a tabletop model of the plant growth chamber rather than a full sized, lunar structure that is designed to grow enough food for the entire lunar crew.

Engineers must work with the limits (or constraints) of mass, weight, and space on a rocket to successfully accomplish the mission.

Materials for Packing Up for the Moon

The following is a suggested list of materials needed to complete the challenge.

- Digital scale or balance (1)
- Measuring tape (1)
- Rulers
- Grid Paper
- General building supplies

Step 1: Identify the Need or Problem

Based on this information and the challenge introductory video, answer the following questions.

- Using your own words, restate the problem in the form of "How can I design a _____ that will _____?" Be sure to include all expected criteria and constraints.

- What general scientific concepts do you and your team need to consider before you begin solving this need or problem?

Step 2: Research the Need or Problem

Conduct research to answer the following questions related to the challenge problem.

Cite where you found your information on the line labeled “Source(s).

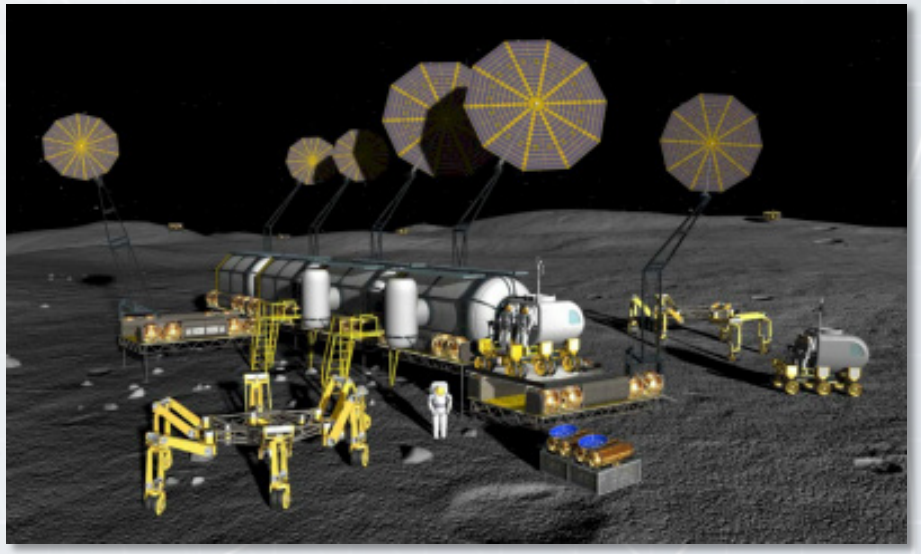
- Who is currently working on this or a similar problem today: What solutions have they created or are working on currently?
- What questions would you ask an expert who is currently trying to solve problems like this one?
- Who in our society will benefit from this problem being solved? How could this relate to everyday use?

Step 3: Develop Possible Solutions

- Sketch your idea for a tabletop model of a plant growth chamber that can be folded, stowed, and shipped on a rocket destined for the Moon in the space provided. Label each part of your drawing. Consider the following questions when brainstorming your ideas.
- What are all the different ways I can imagine to solve this?
- What do we need to add to the design?
- What could go wrong if we add to the design?
- Are all the criteria and constraints addressed?

Step 4: Select the Best Possible Solution(s)

Work with your team to share ideas and answer each other's questions. Discuss and record some strengths and weaknesses from each design and determine which solutions best meets the original need or solves the original problem. This may include features from more than one design.



Step 5: Construct a Prototype

Make a team drawing of your final prototype and have it approved by your educator.

Determine who in the group is doing what.

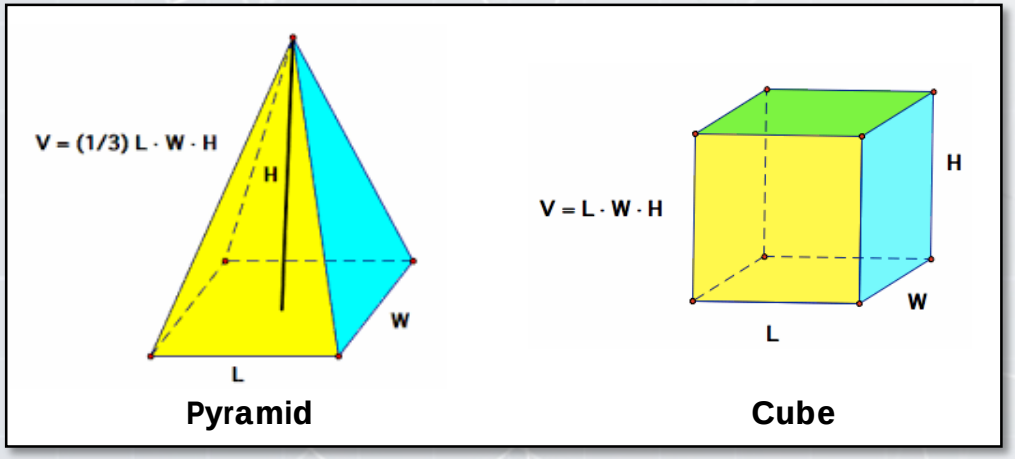
Team member	Responsibility

Are each of the criteria represented in the final design?

Criteria	Addressed in final design?
1.	Yes No
2.	Yes No
3.	Yes No
4.	Yes No

Step 6: Test and Evaluate the Solutions(s)

Work with your team to complete and test the prototype. Complete the table and record the data from each iteration. Be sure to record the changes you made from one iteration to the next in Step 7 of the Student Journal.



Iteration	Model shape	Stowed volume	Deployed volume	Mass
1.				
2.				
3.				
4.				

Step 7: Communicate the Solution(s)

It is not enough to just collect data during testing. Scientists and engineers need to interpret the data so that they can convince others that their results are meaningful. This step will help your team keep a log of the design changes through each design and build cycle. Start by filling out the table about your initial prototype.

Iteration number	What are the key components to your initial prototype?	What do you think caused the design to succeed or fail during testing and why do you think that?
1		
Iteration number	**What was added, removed, or changed in this iteration of your design?**	**What do you think caused the design to succeed or fail during testing and why do you think that?**
2		
3		

Step 7: Communicate the Solution(s)

It is important to think about every step your team makes during the engineering design process. Document each step your team worked through by writing a short description of the work completed by your team in the Team Progress Chart. This will help your team stop, discuss, and decide what to do next in the process. After you finalize your design, use the Student Presentation Organizer to help explain the steps you took to reach your solution and create the script for your video.

Team Progress Chart

Step no.	Step name	What did you do and why?	Documentation for the video

Student Presentation Organizer

Welcome	Introduce your team, provide the title of your video, and explain what challenge your team worked on.	
Engineering Design Process Steps	**Ideas for what should be included in each step of the video**	**Take notes on what your team wants to show and say in the video.**
Step 1: Identify the Need or Problem	Talk about the problem and the constraints. Discuss what constraints will need to be met to solve the problem.	
Step 2: Research the Need or Problem	Discuss what your team discovered during the research and the connections with a NASA subject matter expert. Who did you speak with? What did you learn? Where did you find answers to your questions?	

Step 8: Redesign

Did this iteration of your team design meet all of the constraints of the original problem?

What design problems did the team identify during testing?

What did the team do to improve the next iteration of this design?

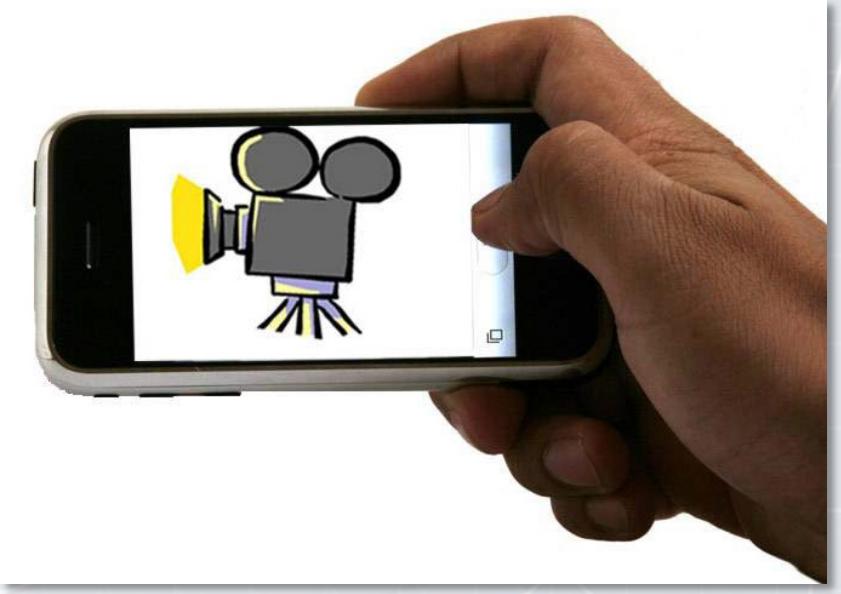
What did and did not work?

Packing Up for the Moon Video

Conclusion

Students you have completed

- Creating a video documenting what the team has done during the engineering design process and challenge
- Student Presentation Organizer
- Determine the video meets the criteria for submission
- Submit the video for review



Packing Up for the Moon Video

To submit your final video, visit the Web site at http://y4y.ed.gov/stemchallenge/nasa for instructions.