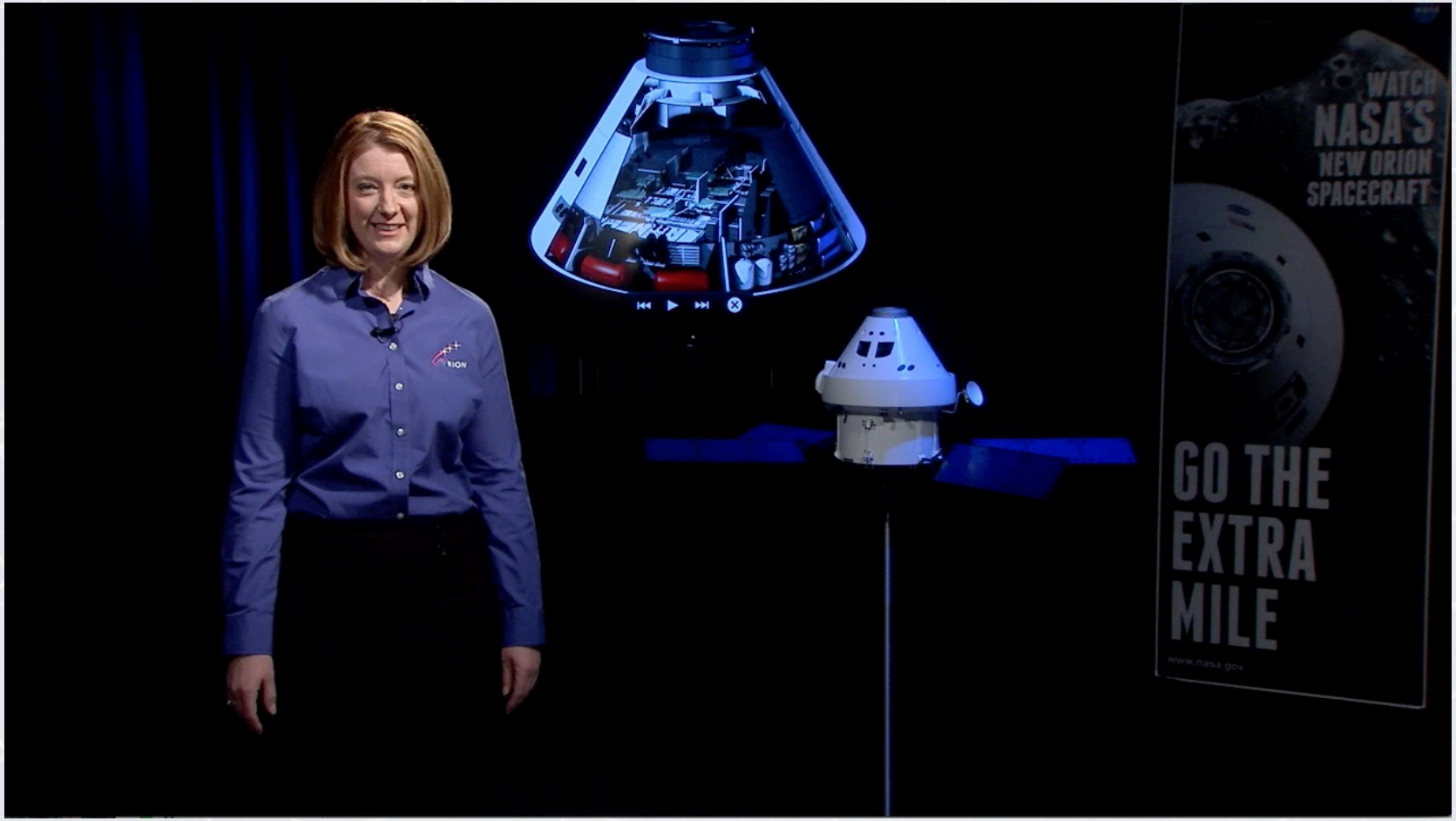
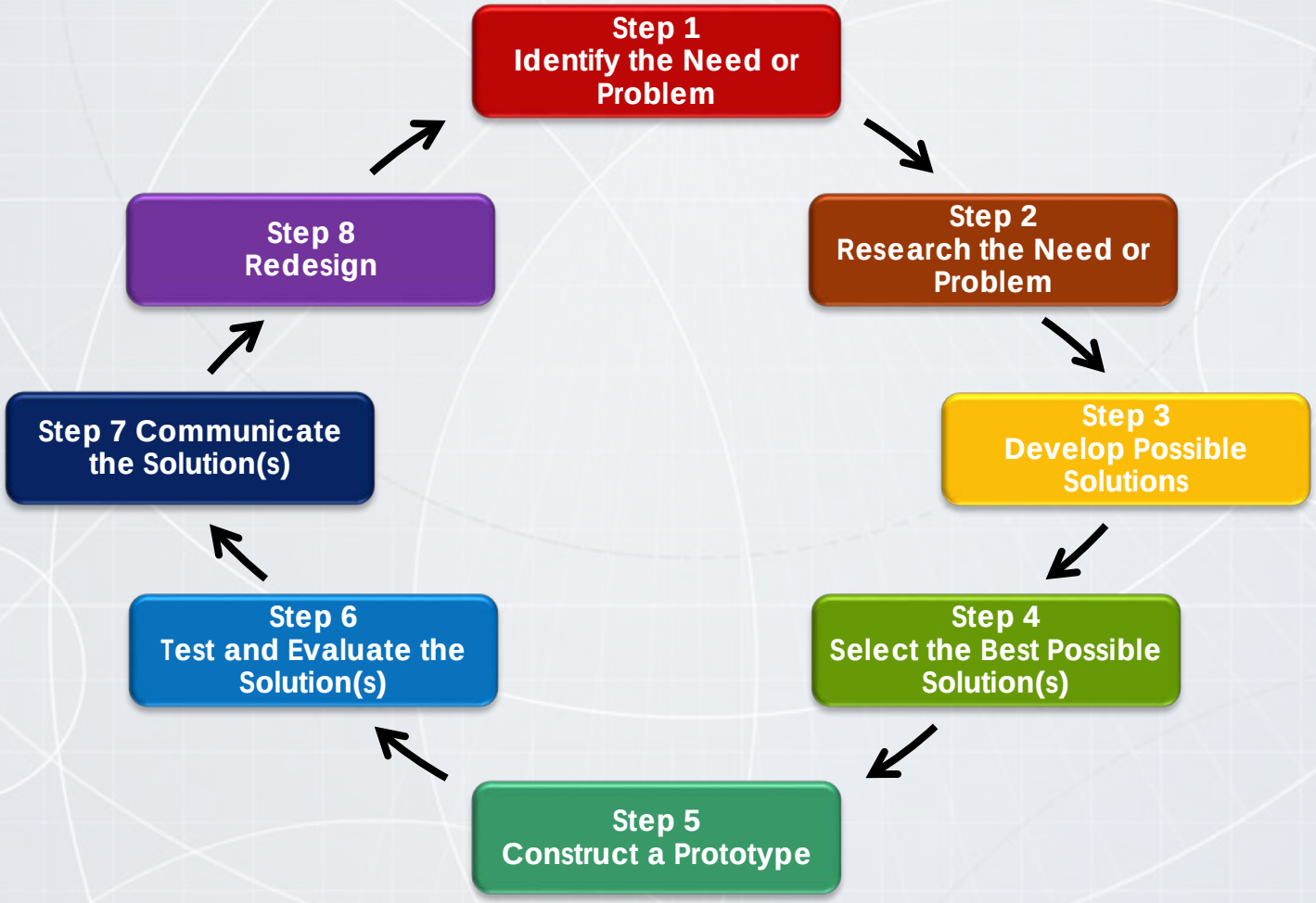
Crew Exploration Vehicle Design

Design a Crew Exploration Vehicle



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

Engineering Design Process



Design a Crew Exploration Vehicle

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.

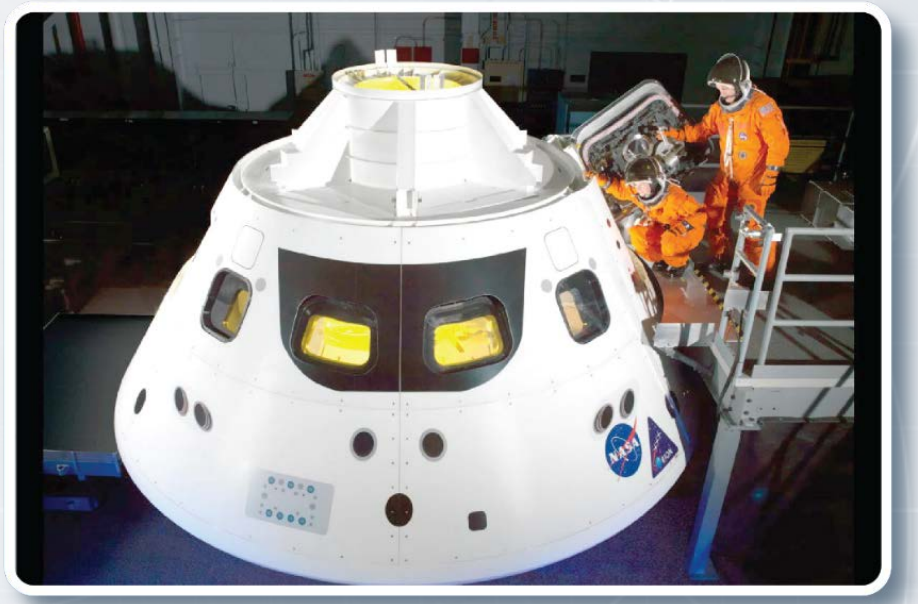
The **WONDER** section is where you list new questions you are wondering about as you complete research.

Know, Learn, Evidence, Wonder (KLEW) Chart

Know	Learn	Evidence	Wonder
What do I know about CEVs and space travel?	What did I learn about CEVs and traveling into space based on my research?	What evidence do I have that supports what I learned about the CEVs and space travel?	What am I still wondering about the CEVs and space travel?

The Challenge—Crew Exploration Vehicle

NASA needs a new vehicle to take astronauts to the Moon, Mars, and beyond. The spacecraft that NASA and its industry partners are working on is called the Crew Exploration Vehicle (CEV). The CEV will transport human crews beyond low-Earth orbit and back again. Each CEV must be designed to serve multiple functions, operate in a variety of environments, and must also have an internal tank for fuel.



Materials for Crew Exploration Vehicle

Materials for Crew Exploration Vehicle

- General building supplies
- Digital scale or balance (1)
- Measuring tape (1)
- Rulers
- Mailing tube, oatmeal canister, or small coffee can (used as size constraint—allow students to fill in this information on the Challenge sheet)
- 3- to 7-cm plastic people (for example, Lego® or Playmobil®) (2)
- Grid paper

Preactivity setup

Select a size constraint, like a mailing tube, oatmeal canister, or coffee can and share the constraint with your students to give them an idea of the types of constraints that NASA engineers work with during a design project.

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.

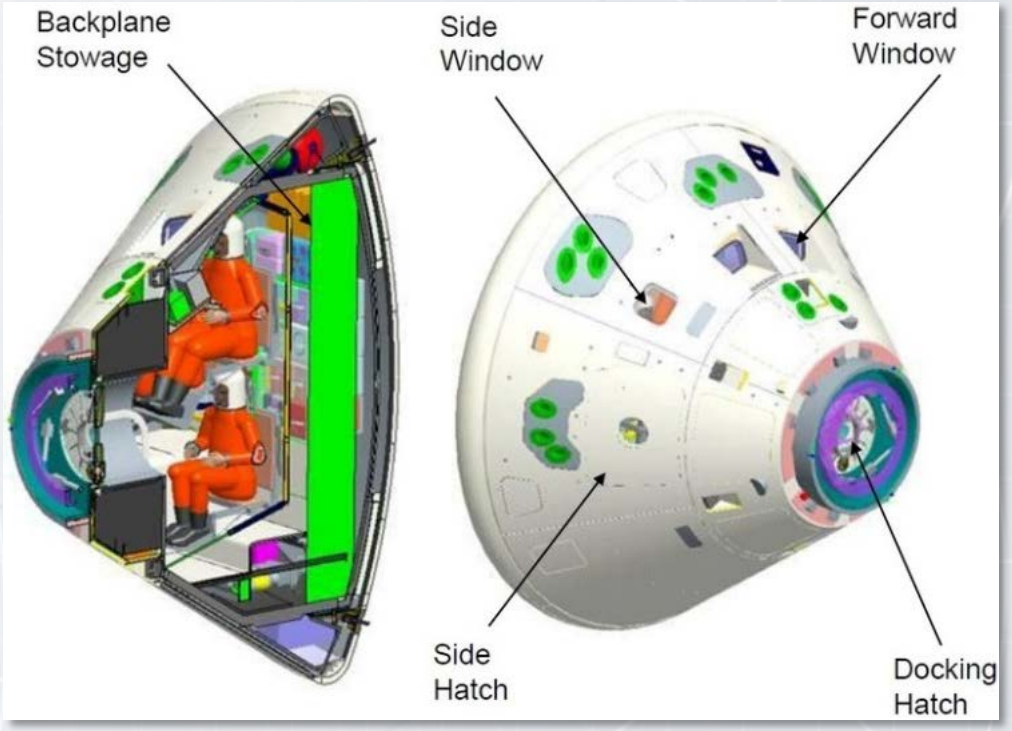
Cite where you found your information on the line labeled "Source(s)."

- 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

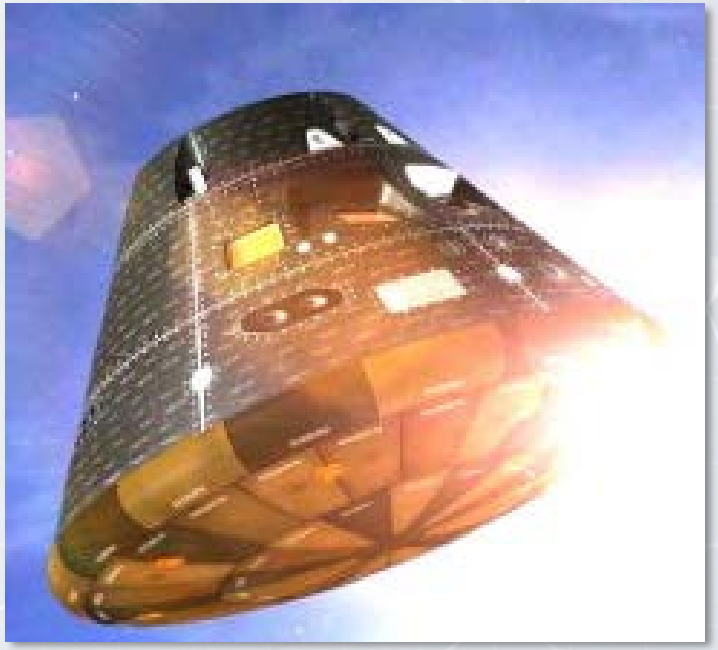
Sketch your idea for a Crew Exploration Vehicle (CEV) in the space provided. Label each part of your drawing. Consider the following questions when brainstorming your ideas.

- 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

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.

Vehicle components	Use	Measurement or calculation
Astronauts	Crew	Mass: _____grams each _____grams total
Crew Exploration Vehicle (CEV)	Carries crew to Moon	Mass: _____grams
Hatch	Allows entry and exit	Dimensions: _____cm (long) by _____cm (wide)
Internal tank	Stores liquid fuel	Mass: _____grams Volume: _____cm^3
Size constraint	Tests size constraints	Volume: _____cm^3

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?	

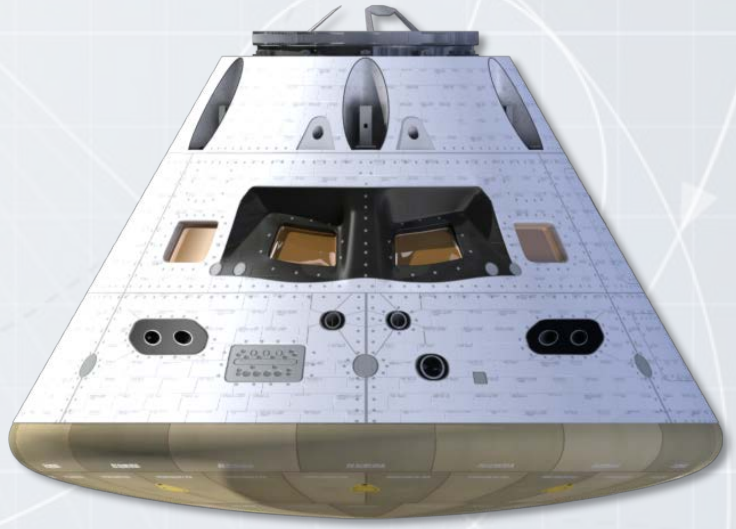
Step 8: Redesign

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?

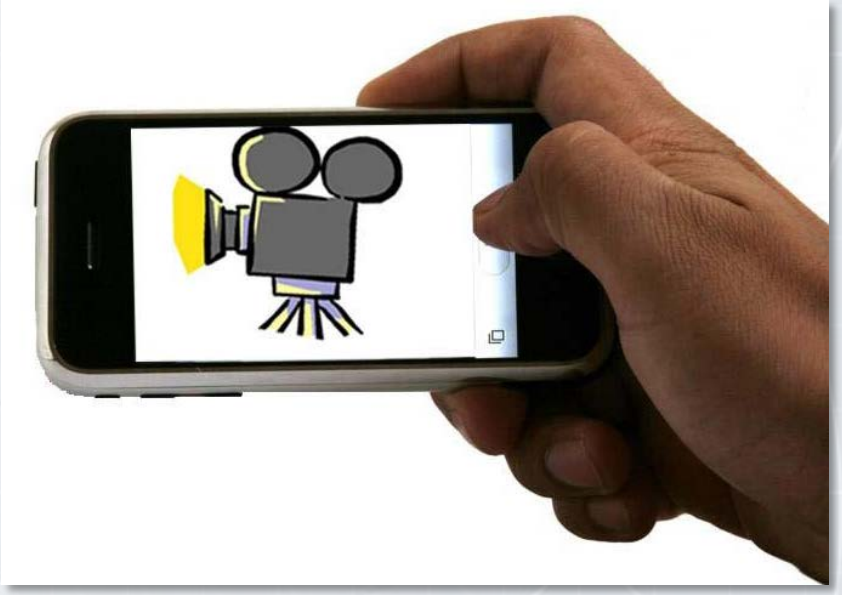


Design a Crew Exploration Vehicle Video

Conclusion

Students you have completed

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



Design a Crew Exploration Vehicle Video

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