National Aeronautics and Space Administration

NASA eClips™

Educator Guide

Our World: Recycled Crew Exploration Vehicle

Educational Product	
Educators & Students	Grades 4-5

NP-2008-09-105-LaRC

www.nasa.gov

Recycled Crew Exploration Vehicle

Grade Level: 4-5
Subjects:
Elementary mathematics
Science

Teacher Preparation Time:
30 – 40 minutes

Lesson Duration:
Four 55-minute class meetings

Time Management:
Class time can be reduced to two 55-minute time blocks if some work is completed at home.

National Standards

National Science Education Standards (NSES)
- Science and Technology

National Council of Teachers of Mathematics (NCTM)
- Measurement
- Geometry

International Technology Education Standards (ITEA)
- Abilities for a Technological World
- Design

Lesson Overview

Students are introduced to the Orion Crew Exploration Vehicle (CEV) and NASA's plans to return to the Moon in this lesson. They work in teams to think and act like engineers as they design and build a model of their own CEV using recycled materials.

This lesson is developed using a 5E model of learning. This model is based upon constructivism, a philosophical framework or theory of learning that helps students connect new knowledge to prior experience. Students brainstorm required components for a CEV to carry human cargo to the Moon in the ENGAGE section of the lesson. Through the use of a NASA eClips video segment they learn about different propulsion systems for speedy and safe travel in space. In the EXPLORE section, teams of students design their own CEV based upon group consensus of required components.

During the EXPLAIN section, students share their designs and justifications for choices included in the design. They also compare their own designs to the Orion crew module and compare attributes of the Orion and Apollo capsules, looking for similarities and differences. Working as a team, students create their model using recycled materials in the EXTEND section of this lesson.

Student understanding is assessed throughout the lesson and students revisit the Essential Questions during the EVALUATE section.

Icons flag five areas of interest or opportunities for teachers.

- TECHNOLOGY highlights opportunities to use technology to enhance the lesson.
- MODIFICATION denotes opportunities to differentiate the lesson.
- RESOURCES relates this lesson to other NASA educator resources that may supplement or extend the lesson.
- CONNECTIONS identifies opportunities to relate the lesson to historical references and other topics or disciplines.
- CHECKING FOR UNDERSTANDING suggests quick, formative assessment opportunities.

Enduring Understandings:

These *Project 2061 Benchmarks for Science Literacy* guide teachers as they work to improve science literacy for all students.

3rd-5th Grade

- There is no perfect design. Designs that are best in one respect may be inferior in other ways.
- Clear communication is an essential part of doing science. It enables scientists to inform others about their work, expose their ideas to criticism by other scientists, and stay informed about scientific discoveries around the world.
- Sometimes it is possible to use the materials from discarded products to make new products, but materials differ widely in the ease with which they can be recycled.

Essential Questions

- What are scientists and engineers doing to return people to the Moon?
- How is their work changing what we know about science and technology?

Instructional Objectives:

Students will

- collaborate with group members to design a model CEV for space exploration;
- compare group designs within the class, identifying symmetry and geometric shapes;
- compare the Orion and Apollo space capsules; and
- transform a 2-dimensional drawing into a 3-dimensional object by constructing the CEV model.

NASA Background:

The history of NASA's space program is filled with dreams that, through much hard work, have become realities. Each challenge required new or modified designs in spacecraft. Each success was the final product of many tests and redesigns.

NASA has allowed us to turn what was once science fiction into science fact. In 1865, Jules Verne seemed to be looking into the future in his science fiction book *From the Earth to the Moon*. In this book, three men are launched to the Moon from Florida. Just like the Apollo astronauts in the 1960s, they experience reduced gravity, which makes them feel weightless in space. The book's characters also use retrorockets and return to Earth by landing in the ocean. What was once only imagination, NASA turned into achievements.

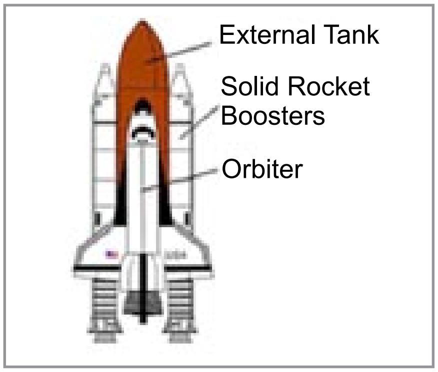


Figure 1: The components of the space shuttle system: Orbiter, External Tank, and Solid Rocket Boosters. ***Image Credit:*** *NASA*

But it took many steps to get where we are today in space exploration.

NASA's human spaceflight program used three similar – yet slightly different - spacecraft to help astronauts prepare and ultimately land on the Moon. The Mercury program (1961-63) used a space capsule that could hold one astronaut. Its cone-shaped design was kept and used with the larger two-man capsule for NASA's Gemini program (1965-66). The same design was still evident in the even larger three-man capsule for the Apollo program (1968-72).

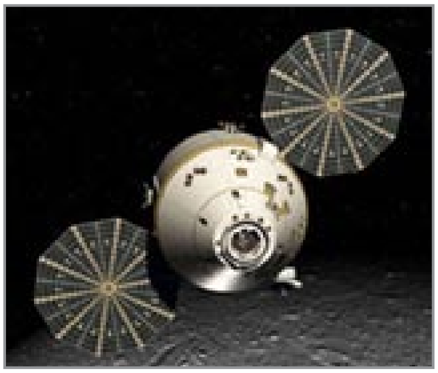


Figure 2: Orion orbits the Moon with disc-shaped solar arrays tracking the sun to generate electricity. ***Image Credit:*** *Lockheed Martin Corp*

From 1963 to 1975, NASA tested a group of lifting bodies. The characteristics of these winged research vehicles led to the development of the space shuttle.

Today's space shuttle is a unique spacecraft system (Figure 1). It can operate on land, in the atmosphere, and in space. The space shuttle combines the features of a rocket, aircraft, and glider. It carries satellites and other cargo into Low-Earth Orbit (LEO). LEO is an orbit in which a spacecraft or satellite orbits close to Earth. This range is between 320 to 800 kilometers (200 to 500 miles) above Earth's surface. Orbiting this close to Earth requires that the spacecraft travel very fast to resist the pull of Earth's gravity.

The space shuttle is the first space program to reuse most of its components. The orbiter and solid rocket boosters are reused – only the external tank is not recovered. From its first flight on April 12, 1981, to today, no other spacecraft has been used for so many years.

So, what will replace the space shuttle?

America will send a new generation of explorers to the Moon aboard NASA's Orion Crew Exploration Vehicle (Figure 2). Making its first flight early in the next decade, Orion is part of the Constellation Program to send human explorers back to the Moon, and then onward to Mars and other destinations in the solar system.

Orion will be capable of carrying crew and cargo to the International Space Station. It will rendezvous with a lunar landing module and an Earth departure stage in low-Earth orbit to carry crews to the Moon and, one day, to Mars-bound vehicles assembled in low-Earth orbit. Orion will be the Earth entry vehicle for lunar and Mars returns. Orion's design will borrow its shape from the Apollo capsule of the past, but will take advantage of 21st century technology in computers, electronics, life support, propulsion, and heat protection systems (Figure 3).

Figure 3: Exploded view of Orion.
Image Credit: *Lockheed Martin Corp*

Orion will be similar in shape to the Apollo spacecraft, but significantly larger. The Apollo-style heat shield is the best understood shape for re-entering Earth's atmosphere, especially when returning directly from the Moon. Orion will be 5 meters (16.5 feet) in diameter and have a mass of about 22.7 metric tons (25 tons). Inside, it will have more than two-and-a-half times the volume of an Apollo capsule. The larger size will allow Orion to accommodate four crew members on missions to the Moon, and six on missions to the International Space Station or to low-Earth orbit in order to transfer to a Mars-bound spacecraft.

Figure 4: A concept image shows the Ares V cargo launch vehicle launching from NASA's Kennedy Space Center, Florida. ***Image Credit:*** *NASA/MSFC*

A launch abort system atop the Orion capsule will be capable of pulling the spacecraft and its crew to safety in the event of an emergency on the launch pad or at any time during ascent. For missions to the Moon, NASA will use two separate launch vehicles, each derived from a mixture of systems with heritage rooted in Apollo, space shuttle, and commercial launch vehicle technology.

Landing on the Moon

An Ares V cargo launch vehicle will precede the launch of the crew vehicle, delivering to low-Earth orbit the Earth departure stage and the lunar module that will carry explorers on the last leg of the journey to the Moon's surface (Figure 4). Orion will dock with the lunar module in Earth orbit, and the Earth departure stage will propel both on their journey to the Moon. Once in lunar orbit, all four astronauts will use the lunar landing craft to travel to the Moon's surface, while the Orion spacecraft stays in lunar orbit.

Once the astronauts' lunar mission is complete, they will return to the orbiting Orion vehicle using a lunar ascent module. The crew will use the service module main engine to break out of lunar orbit and head to Earth. Orion and its crew will reenter Earth's atmosphere using a newly developed thermal protection system. Parachutes will further slow Orion's descent through the atmosphere.

Sources:
NASA 21st Century Explorer: http://education.jsc.nasa.gov/explorers/p5.html
NASA Website: http://www.nasa.gov/mission_pages/constellation/orion/index.html
For more information about Orion and the Constellation Program, visit
http://www.nasa.gov/mission_pages/constellation/main/index.html

5E Inquiry Lesson Development

RESOURCES This lesson is derived from *NASA's 21st Century Explorer Lesson, Designing A Crew Exploration Vehicle*, ***http://education.jsc.nasa.gov/explorers/pdf/p5_educator.pdf***

MODIFICATION For students with special needs, complete all parts of the ENGAGE, EXPLORE, and EXPLAIN sections as a class. Run the discussion and brainstorm session as a large group. Organize the class to design the CEV together on a large piece of chart paper or break the group into two or three groups. For the EXTEND section, allow each group (or each student) to build their own CEV but consider providing the same materials for all students instead of having them choose their materials.

ENGAGE (20 to 30 minutes)

1. Post and discuss the Essential Questions: What are scientists and engineers doing to return people to the Moon? How is their work changing what we know about science and technology?

2. Use a KWL chart to organize what students already KNOW and how they know this information, and what students WANT TO LEARN about traveling in space. These questions may guide discussion:

   a. What do you KNOW about past, present, and future space travel? *(Answers vary. Guide students to think about the last time people were on the Moon during the Apollo missions. Ask them what they may know about the space shuttle. Probe to discover what they know (and what they envision or imagine) about NASA's plans to return to the Moon.)*
   b. How do you KNOW this information? *(Reading articles, television, Internet, other sources)*
   c. What would you like to LEARN about traveling to the Moon? *(Answers vary.)*

3. The following text is pulled from the 21st Century Explorer Lesson, *Designing a Crew Exploration Vehicle*. The entire lesson can be found at ***http://education.jsc.nasa.gov/explorers/pdf/p5_educator.pdf***

MODIFICATION This reading passage includes several difficult words that may be hard for young students to understand. Before reading the text, create flashcards with words and pictures for the underlined words in the text below. Post the flashcards as you read the text to reinforce key concepts and introduce new vocabulary.
TECHNOLOGY Use a classroom computer or SmartBoard to list the words.

The space shuttle is the world's first reusable spacecraft. It is also the first spacecraft that can carry large satellites in and out of orbit. The space shuttle orbits Earth in what is called low-Earth orbit. This orbit is close to Earth, between 320 to 800 kilometers or 200-500 miles above Earth.

The space shuttle cannot go to the Moon or to Mars. Since we hope to send people back to the Moon, we need to design a new spacecraft.

NASA scientists and engineers are working on a spacecraft that can carry astronauts to the Moon. This spacecraft is called the Orion Crew Exploration Vehicle (CEV). It will carry people to the Moon and back again.

4. Brainstorm as a class to identify parts needed for the design of a CEV that will carry human crews.
   Guide discussion to include:
   - a place for the crew;
   - power sources (fuel tank, rocket boosters, fuel cells);
   - storage space for life support (air, water, food, and waste); and
   - landing system.

MODIFICATION For individual brainstorming use the graphic organizer included in the Student Handout.

5. TECHNOLOGY Show the NASA eClips video segment *Propulsion Systems* for an overview of different propulsion systems being considered for NASA's return to the Moon. This segment can be found at NASA eClips You Tube™, ***http://www.youtube.com/watch?v=CMnsn9Jwepg&feature=PlayList&p=31002AD70975DC1B&index=3***

6. RESOURCES To help students visualize the time it takes to travel to the Moon, planets and some stars, show the NASA eClips video segment *Traveling to the Moon and Mars*. This segment can be found at NASA eClips You Tube™,
   http://www.youtube.com/watch?v=g5dz3yMeH1s&feature=PlayList&p=31002AD70975DC1B&index=0

EXPLORE (40 to 50 minutes)

MODIFICATION Class time may be reduced if students develop their own design independently as homework.

CHECKING FOR UNDERSTANDING An evaluation rubric is included to evaluate student work in the EXPLORE, EXPLAIN, and EXTEND sections of this lesson.

1. Organize students into Design and Engineering teams.
   RESOURCES Find out more about how to organize these teams and the design process from *NASA's Lunar Nautics Educator Guide*, ***http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Lunar_Nautics_Designing_a_Mission.html***. This guide contains activities that lead to designing a mission to live and work on the Moon. Pages 118 – 119 offer tips for forming and implementing design teams.

2. Present the students with this problem:
   Design and build a model of a CEV using recycled and reusable materials.

3. Review the Background Information and the engineering design process (see Figure 5) in the Student Handout with students and discuss the previous brainstorming activity.
   TECHNOLOGY Encourage students to visit these websites to look at drawings engineers have created for Apollo and Orion.
   NASA Orion – Crew Exploration Vehicle Photo Collection,
   http://www.dfrc.nasa.gov/Gallery/photo/Orion/index.html and *NASA Project Apollo Drawings and Technical Diagrams*, ***http://history.nasa.gov/diagrams/apollo.html***

4. Challenge students to design a CEV on graph paper using basic geometric shapes and units of measurement. Provide students with an example of a technical drawing (see figure 5).
   MODIFICATION Ask advanced students to measure drawings using appropriate units of measurement.

5. As a group, discuss what should be included in students' drawings. Some possible details:
   - labels for all parts, identifying the length of the sections within the drawing
   - a materials list
   - a name for the spacecraft
   - a list of all group members

6. CONNECTIONS Challenge students to include and label simple machines in their designs.

EXPLAIN (30 to 40 minutes)

1. Provide time for students to explain their drawings to classmates. Ask students to discuss reasons behind the choices they made in their design.

2. CHECKING FOR UNDERSTANDING Ask teams to trade drawings with another group and answer these questions about the design they receive.

   a. What are the three features of the design that you like most? *(Answers vary.)*
   b. What basic geometric shapes can you find within the design? *(Answers vary.)*

   MODIFICATION For advanced students:

   c. Is the design symmetrical? Why is a symmetrical design important in space travel? *(Answers vary. Symmetrical design helps maintain balance.)*

3. TECHNOLOGY Show the NASA eClips video segment *21st Century Crew Exploration Vehicle* to learn more about the Orion CEV. This segment can be found at NASA eClips™ You Tube™, ***http://www.youtube.com/watch?v=kfuibrk22RU***

4. Based upon information from the video segment, have students compare their drawings to Orion.

5. The Orion CEV is similar to the Apollo crew module. Show students pictures of the Apollo crew module and Orion (Teacher Resources). Ask students to compare the images of the Apollo and Orion crew modules and to consider what choices were made in the design of both. Guide them to think about choices in shape, materials, and cost. Discuss how there are no "perfect" designs and that there are often several designs that may suit particular needs. Have students complete the graphic organizer to compare and contrast the Apollo and Orion crew modules.

   MODIFICATION Provide print copies of the Apollo and Orion figures for each group as needed.

MODIFICATION and TECHNOLOGY If available, consider having students develop their own graphic organizer comparing and contrasting the Apollo and Orion crew modules. Possible programs to design graphic organizers include Kidspiration™ and Inspiration™.

6. These questions may guide discussion once students complete the graphic organizer.

   a. How are the spacecraft the same? *(the blunt body shape of the capsule and the launch vehicles)*
   b. How are they different? *(the number of crew members that can fit: Apollo 3, Orion 4-6; the landing systems: the Apollo was designed to land in water; Orion will be designed to land in the water or in the desert; the crew and the cargo will be separated on the Orion; the heat shield on the Orion is stronger; the technology on the Orion is more advanced)*
   c. Why are the designs similar? *(The space shuttle isn't designed for missions to the Moon and beyond. The new vehicle is designed to travel for Moon missions. The Apollo missions were successful. It seems reasonable to improve upon an already successful model.)*
   d. Does your CEV design include any of the same characteristics as either the Apollo or Orion? Why did you include those characteristics? *(Answers will vary)*

EXTEND (40 to 50 minutes)

MODIFICATION Class time may be reduced by assigning students to complete the models as homework.

1. Ask students to revisit their designs and make changes or modifications based on what they have learned throughout the lesson.

2. Discuss any additional modifications students may need to make as they create a 3-dimensional model using their 2-dimensional drawing.

3. Discuss these questions about materials with students.

   a. The model will be constructed of readily available, reusable materials. What materials are available? (Answers vary but should include paper towel rolls, yogurt cups, empty 2-liter bottles, jar lids, wire, empty cereal boxes, etc.)
   b. What kinds of materials are better than others for the model? *(Answers vary, but should include discussions about shape, strength, and availability.)*

4. Students may bring in recycled materials from home, but be sure to provide materials for the class to choose from as well.

5. Remind students about the importance of classroom and lab safety. Be sure recycled materials are clean and dry with no sharp edges.

6. EDUCATOR ONLY: Use an appropriate tool or instrument to poke holes in the containers for the students. A hot-glue gun may also be helpful to attach or build the CEV.

7. Encourage students to add notes to their design as they build to indicate changes from the original design plans. Ask students to use a different color pencil for these notes.

8. CONNECTIONS Reinforce the importance and benefits of recycling for the environment.

9. Display the models. Ask student to look for things that are the same or different about the designs. What patterns are found? *(shapes, proportions,)*

10. Ask each team to present their model and explain their choices.

EVALUATE (30 to 40 minutes)

Choose from the activities below to evaluate your students' understanding.
MODIFICATION Class time may be reduced by assigning sections to be completed as homework.

1. Have students return to the KWL chart from the ENGAGE section to complete what they have LEARNED throughout this experience.

2. Have students revisit the Essential Questions and write a paragraph based upon learning from this lesson.
   - What are scientists and engineers doing to return people to the Moon? How is their work changing what we know about science and technology? *(Answers vary. Returning to the Moon challenges scientists and engineers to design faster, safer space capsules able to carry a human crew.)*

3. Ask students to critique their 3-dimensional model. Ask them to include:
   - how the design changed throughout the design process and why; and
   - what are strong points in their design and what changes they would make now.

4. When the CEV designs are complete, ask students to write a short statement to convince NASA that their CEV is worthy of future space exploration.

5. Use questions, discussions, student handouts, and the evaluation rubric from the lesson to assess students' understanding.

6. Ask students what new questions about space and space exploration they might have. *(Answers vary)*

7. MODIFICATION Ask students to consider:

   a. If you could have used other materials, how would you have designed your CEV? *(Answers vary)*
   b. Launch and entry stages are difficult for astronauts due to forces more than three times Earth's gravity. Challenge students to redesign their CEV to help astronauts withstand these forces.

APOLLO

Figure 1: National Air and Space Museum, Smithsonian Institution ***Image Credit:*** *Eric Long/ NASM, Copyright: Smithsonian Institution*

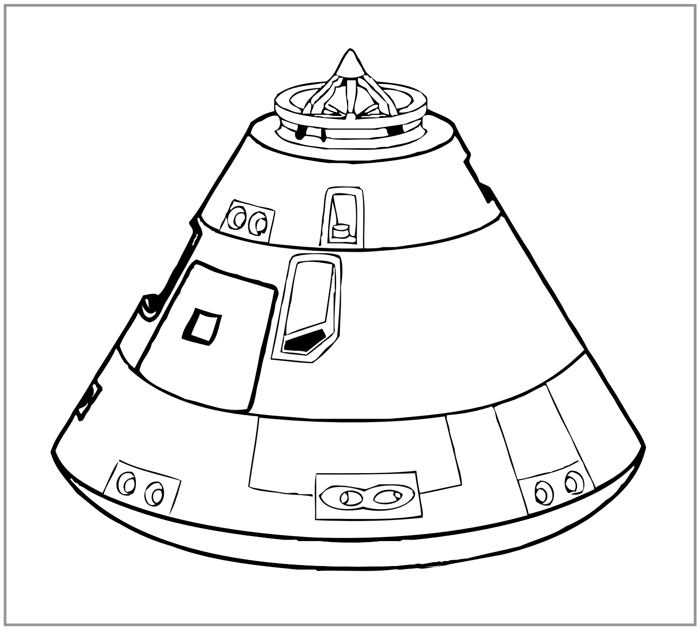


Figure 2: Apollo Diagram

ORION

Figure 3: Exploded view of Orion.
Image Credit: *Lockheed Martin Corp*

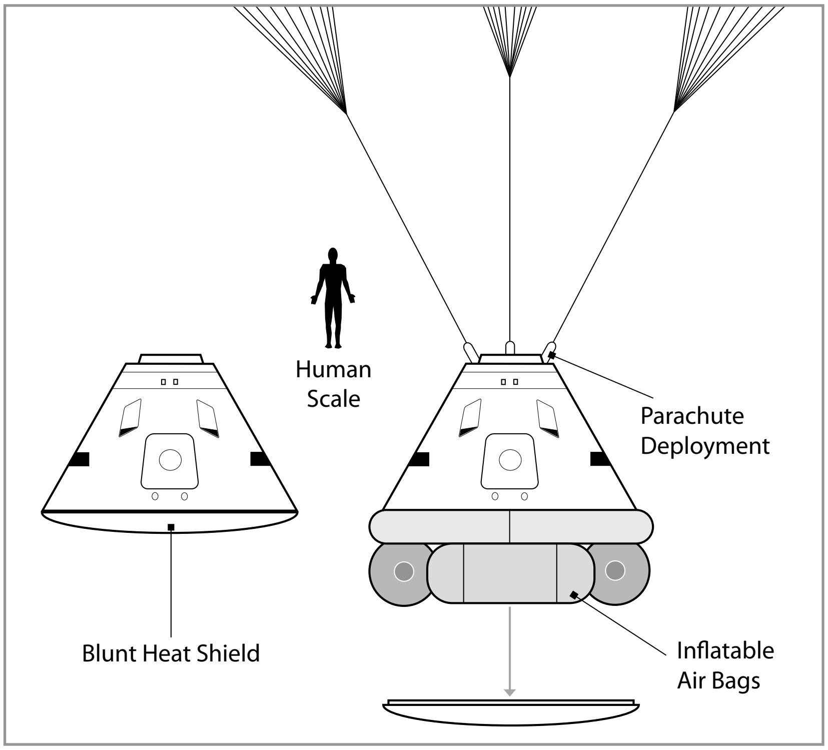


Figure 4: Orion Diagram

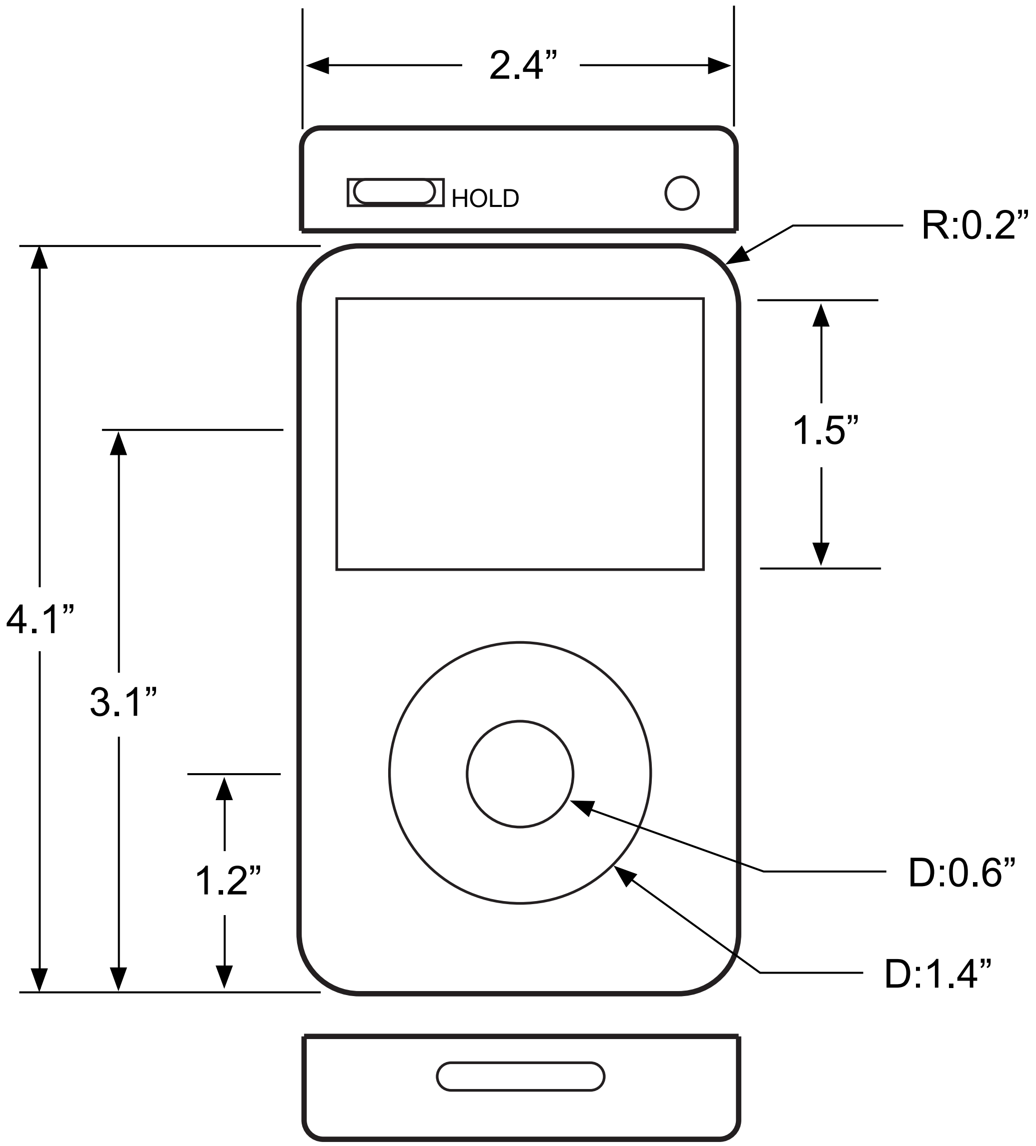


Figure 5: Technical drawing of a music device

Group Members: ____

____

Rubric Category	Score
Design • The design has these parts: a place for the crew, storage space, a way to power the CEV, and a way to land. • Choices for parts included in the design can be explained and defended by the team. • All items are labeled. • If assigned, accurate measurements are included on the drawing.	
Compare and Contrast • The Apollo and Orion Chart is complete. Three things that are the same for the Apollo and Orion capsules are listed. Three things that are true only about the Apollo capsule are listed. Three things that are true only about the Orion capsule are listed. • Reasons are given for each choice above.	
Build - A model was constructed based on the original design. • Any changes are marked on the design page. • Reasons for design changes are given. • Only recycled materials are used to make the model. • Reasons for material choices are given.	
Evaluate • All questions in the student handout are completed. • Answers are correct and make sense.	
Teamwork • Work is shared equally. • Each member of the team contributes ideas and suggestions.	
TOTAL (out of 20 pts possible)	

4 (Excellent) = All criteria (procedures, steps, and details) are met or followed.
3 (Good) = Most criteria are met with only a few mistakes.
2 (Fair) = Many criteria are not met and/or there are many mistakes.
1 (Poor) = Most criteria are not met.
0 (No effort) = No effort to meet criteria.

Essential Questions

What are scientists and engineers doing to return people to the Moon? How is their work changing what we know about science and technology?

During this lesson, you will

- use the design process to design a model CEV for future space exploration;
- build a model based on your design;
- compare your results to class results and look for parts that are the same; and
- evaluate and redesign the model.

ENGAGE
Brainstorm

Places for the Crew	Storage Spaces
Components Essential to a Successful CEV Design	
Ways to Power the CEV	Ways to Land

EXPLORE

What is the problem?

Design and build a model of a CEV using recycled and reusable materials.

Background Information

The space shuttle is the world's first reusable spacecraft. It is also the first spacecraft that can carry large satellites in and out of orbit. The space shuttle orbits Earth in what is called low-Earth orbit. This orbit is close to Earth, between 320 to 800 kilometers or 200-500 miles above Earth.

The average distance from the Earth to the Moon is about 385,000 km (240,000 miles). Astronauts can reach the Moon in about three days. Mars is much farther away from the Earth. When they are closest to each other, the distance from the Earth to Mars is almost 55 million kilometers. When astronauts travel to Mars, it will take them nearly ten months to get there. The space shuttle cannot go to the Moon or to Mars. It was not designed to travel to outer space. Since we hope to send people back to the Moon, we need to design a new spacecraft.

NASA scientists and engineers are working on a spacecraft that can carry astronauts to the Moon. This spacecraft is called the Orion Crew Exploration Vehicle (CEV). It will carry people to the Moon and back again.

As you design and create your models, you will be working like the Apollo and Orion engineers. Like them, you will be following the engineering design process shown on the next page.

Design Process - Steps of the Five-Step Design Process:

1. ASK
- What is the problem?
- What have others done?
- What are the limits?

2. IMAGINE
- What are some solutions?
- Brainstorm ideas.
- Choose the best one.

3. BUILD
- Draw a diagram.
- Make lists of materials you will need.
- Follow your plan and build it.

4. EVALUATE
- Test it out!
- Record your results.
- Make changes to improve it.

5. SHARE
- Explain your ideas to others.

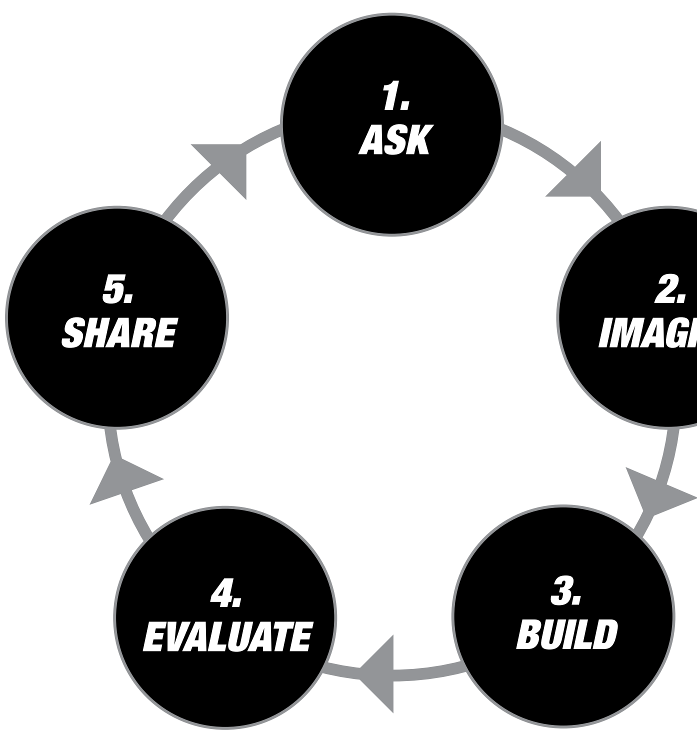


Figure 6: Steps to the Design Process

Vocabulary

astronaut - An astronaut is a person who is trained to travel into space.

criteria - Criteria are rules guiding the design process, such as size, type of material, or dollar limit to build the model.

Crew Exploration Vehicle (CEV) – The Crew Exploration Vehicle (CEV) is America's new spacecraft for human space travel. The CEV will carry four crew members to the Moon. It can carry six crew members on missions to the International Space Station or to low-Earth orbit to transfer to a Mars-bound spacecraft.

engineers - Engineers use math and science to design new tools and devices to solve practical problems.

low-Earth orbit – Low-Earth orbit (LEO) is the path in which a spacecraft or satellite moves around the Earth. This path may be between 320 and 800 kilometers (200-500 miles) above the Earth's surface.

model - A model is a smaller version or scale representation of something else. Rough models are also cheap and fast to create. They are usually made of paper, cardboard, plastic, foam or other materials.

recycled - Used materials that are made into new products are called recycled materials. Recycling reduces the waste of useful materials, and it reduces the need for new materials. Recycling sometimes reduces energy, costs, and pollution.

reusable - Objects or materials that can be used again are called reusable. The objects may be used for the same purpose or different purposes.

scientists - Scientists use systematic methods to study the world around them. They use an organized approach to observe and study the world. They ask questions, look for patterns, and try to find general rules for the natural world.

symmetrical - When an object is balanced, or equal on both sides, it has symmetry and is called symmetrical.

DESIGN

> **MATERIALS for this section**
> - graph paper
> - rulers
> - pencils
> - large erasers

1. List the parts your class wants to include in the CEV. Explain why each part is important.

2. As a team, brainstorm ideas for each part of your design.

3. Choose what you think are the best ideas.

4. Draw the CEV on graph paper. On the drawing, label all parts.

EXPLAIN

1. Explain your drawing to your teacher and classmates. You may make changes based upon their suggestions.

2. Use the chart provided to compare the Apollo capsule to the Orion.
   a. How are the spacecraft the same?

   b. How are they different?

   c. Why are the designs similar?

   d. Does your CEV design include any of the same characteristics as either the Apollo or Orion? Why did you include those characteristics?

EXTEND

Now you get to build your CEV model!

1. What reusable materials are available?

2. What kinds of materials are better than others for your model?

3. Build your CEV based upon your design. Make notes on your design as you build your model. Use a different colored pencil to mark changes.

EVALUATE

1. Answer the following questions:
   a. Did your CEV design change as you built your model? How?

   b. Why was your drawing helpful? How would your drawings and notes help other CEV builders?

   c. List ways all of the CEV models are the same. List ways they are different.

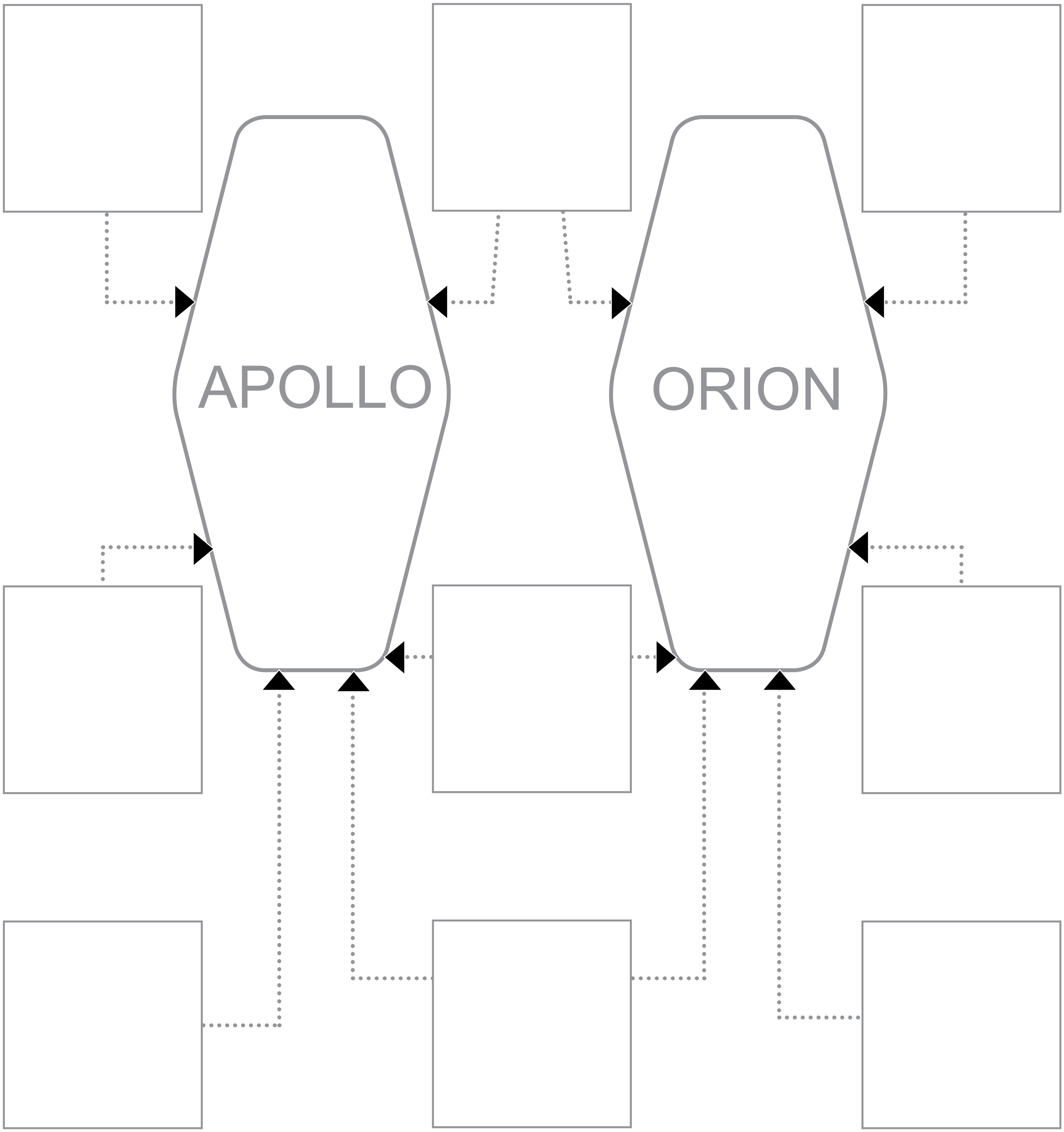
   d. How could you test which model is the best? Decide on a test and try it out.

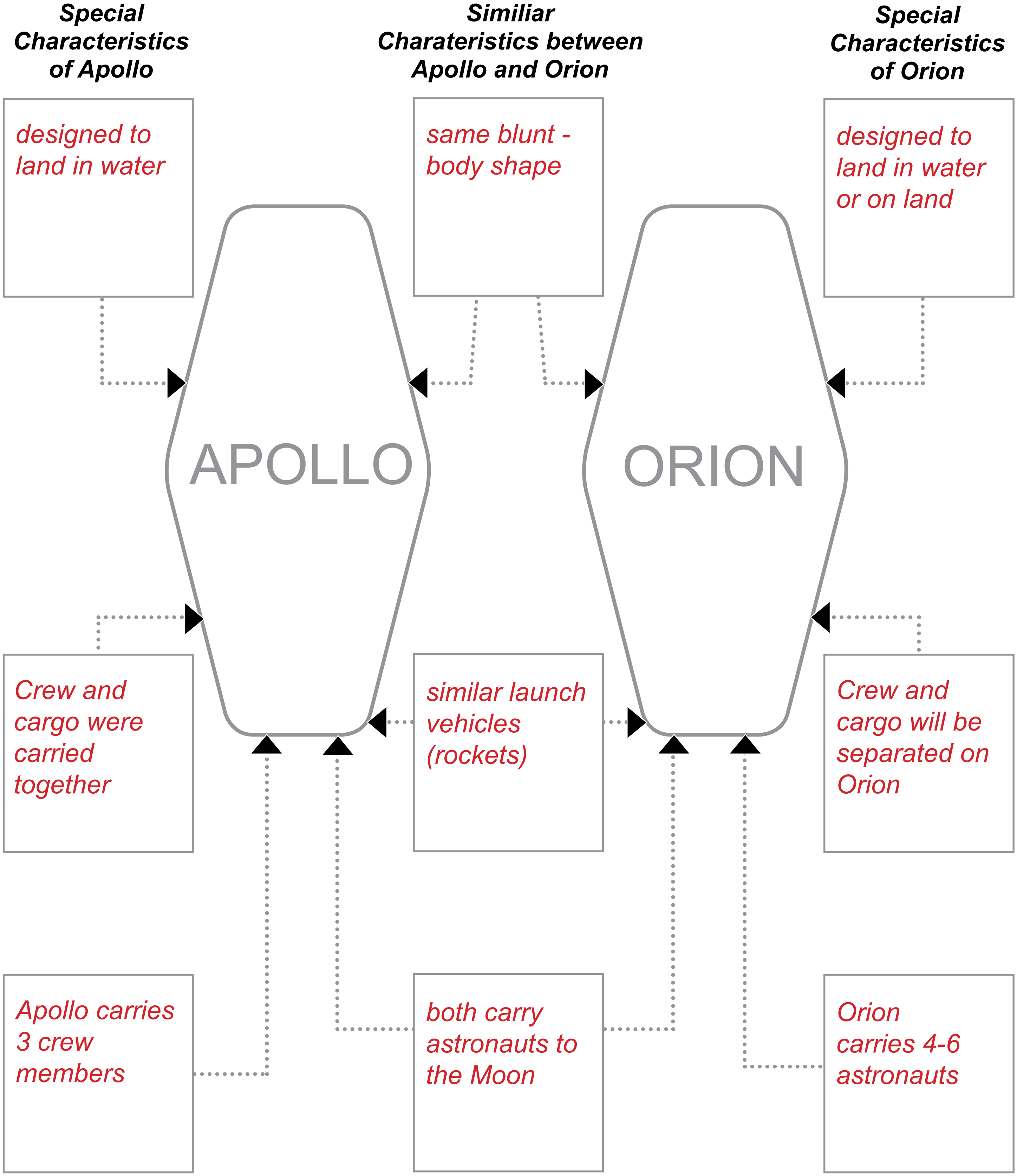
   e. When your CEV is complete, write a paragraph, on a separate sheet of paper, to convince NASA to build your CEV.

Special Characteristics of Apollo

Similiar Charateristics between Apollo and Orion

Special Characteristics of Orion





Answers may vary, but some suggested answers are included.