APOLLO SPLASHDOWN DESIGN CHALLENGE

OVERVIEW
Taking their inspiration from the Columbia Command Module, which safely returned the Apollo 11 astronauts to Earth, learners will design their own module (or capsule) for “splashdown” with the goal of keeping an egg safe after it is dropped from a high height. Learners should engineer their modules using things commonly found around the house while considering how best to ensure their egg’s safety.

The United States sent the first men to the Moon in 1969. Astronauts Neil Armstrong, Buzz Aldrin, and Michael Collins were launched into space by the Saturn V rocket on July 16th. Armstrong and Aldrin touched down on the Moon in the Sea of Tranquility on July 20th. Collins stayed in the command module in lunar orbit, circling the Moon until Armstrong and Aldrin left the Moon’s surface and reconnected with the command module.

The three astronauts returned to Earth in the Columbia Command Module on July 24th, “splashing down” in the Pacific Ocean after being in space for eight days.

LEARNING OBJECTIVE
• Learners will explore and employ elements of the design process when creating their capsule.
• Learners will consider the affect that the forces of flight, gravity and drag, will have on their design and how these forces of flight impacted the Columbia Command Module.
• Learners will explore the history of the Apollo 11 mission and the Apollo program.

VOCABULARY
• DESIGN PROCESS – a step-by-step process that scientists, engineers, architects, and other designers utilize when creating a new product, structure, material, etc. PBS Kids has an excellent PDF that breaks down the steps in the design process.
  o STEPS IN THE DESIGN PROCESS*:
    i. Identify the problem.
    ii. Gather information.
    iii. Generate design ideas.
    iv. Build your design.
    v. Test out your design.
    vi. Reflect on your design and evaluate what worked and what didn’t.
      a. If it worked exactly how you wanted it to, fantastic! Go to step vii.
      b. If it didn’t work perfectly, consider going back and re-evaluating your design ideas, create a new design or modify your existing one, and test it out again. Repeat this process as many times as you want and/or need to.
    vii. Share your results.
  *Different resources may use slightly different terminology when describing the different steps in the design process. However, the overall process should be the same.

• SPLASHDOWN - when a crewed spacecraft lands, or “splashes down” in the ocean upon returning to Earth. Parachutes are deployed during successful landings, helping the modules to land safely
• GRAVITY (OR WEIGHT) – one of the four forces of flight, it is the force that pulls things down towards the Earth.
• **DRAG** — one of the four forces of flight, this force is a resistance for that slows down objects as they move through the air

**MATERIALS**

*Keep in mind that these materials are suggestions. Feel free to experiment with different materials you have at home.*

- Table or other open space for working
- (1) egg (either raw or hard boiled). *We recommend placing the egg in a Ziploc bag and sealing the bag with tape. More eggs may be needed if the learner is employing the design process and needs to re-test their design.*
- Ziploc bag – large enough to hold egg
- Tape (any variety but duct tape works well)
- Scissors
- A few paper towels, paper napkins, tissues, or sheets of toilet paper
- A paper or plastic bowl, a clean, recycled container, or something else that can serve as the body of the module
- Plastic bag(s)
- String or twine.
- Aluminum foil
- A towel or tarp if dropping module indoors

**SET-UP**

→ Learn about the Apollo program, Apollo 11, and the Columbia Command Module.
→ Learn about the forces of flight.
→ Talk about the steps in the design process.
→ Gather and prep your supplies—make sure to keep the egg safe!
→ Using the design process, consider how you will use your different supplies to create your module and come up with your design.
→ Decide where you will drop your module. You will want to find somewhere that it can be dropped from a high height. *Keep in mind that this activity can be messy!* If dropping your module indoors, place a towel or tarp on the spot that you think it will land. If launching outside, make sure that it won’t hit someone or something when it lands. It’s a great idea for an adult to help with this portion of the activity.

**LESSON PLAN**

1) Talk about what you already know about space flight, the Moon, the Apollo program and the Apollo 11 mission. Do some research about the Apollo program, Apollo 11, and the Columbia Command Module—when did people first go to the Moon? How did they get there? How did they return home?
2) Learn about the forces of flight and consider how they affected the Columbia Command Module when it entered Earth’s atmosphere and what engineers had to consider and plan for when it landed. There are many resources listed at the end of this document to help investigate these topics!
3) Discuss the design process and go over its different steps. Discuss what a designer is and some different careers that use the design process regularly. Think about why the design process is important in these fields. Share ways that you think the design process was used in the Apollo missions.
4) Start thinking about how you will build your module and what you will build it with. Use the steps in the design process as a guide. Consider how the forces of flight will affect your module.
5) Build your module.
6) Test your module and evaluate your results. Was your landing successful? (Note: If using a raw egg, an adult may want to help extract the egg from the module as raw egg could spill out)

7) If you’re happy with the result, share what you designed with others! If you think some things could be improved, return to an earlier step in the design process – maybe you need to do some more research, or maybe you were able to quickly identify the problem and you know exactly what needs to be fixed. Repeat the process as many times as you want to in order to get the results that you want!

FURTHER EXTENSION

In the Museum

During your visit to The Museum of Flight, stop by the Apollo Gallery to learn more about Apollo 11 and the Apollo program. Be sure to also visit the Charles Simonyi Space Gallery to learn about more recent advances in space exploration.

SUGGESTED READING/ ADDITIONAL RESOURCES

- “Throwback to Apollo Parachute Testing.” NASA. https://www.nasa.gov/mediacast/throwback-to-apollo-parachute-testing