

FUTURE U.

Moon Tourism

GRADE RANGE 6–8

Objective

After investigating unique qualities of the CST-100 Starliner and calculating how long a voyage to the Moon may take, students will create a convincing advertisement for Moon tourism.

Overview

The CST-100 Starliner is working toward bringing astronauts to the International Space Station . . . but what could come next? After watching a video about the CST Starliner and calculating how long a trip around the moon and back to Earth would take, students will contemplate the idea of moon tourism. In doing so, students will be tasked with designing a marketing campaign to get American tourists interested in taking one of the first trips around the moon! Students will be encouraged to consider the unique-ness of this trip as well as the traveling conditions in order to create a marketing campaign that targets consumers. They will then create the campaign's first "buzz" as they launch a model rocket!

STEM Topics

Science, Technology, Expressions & Equations

Timing

45–60 minutes

Materials Needed

- Device with the ability to project
- CST-100 Starliner [video](#)
- White board and marker or chart paper and marker – whichever the classroom already has available
- Moon Tourism Handout, 15 copies
- Article Excerpts Handout, 35 copies
- 5 x 8-inch notecards, 15

Rocket Supplies

- Empty film canister with lid that snaps inside, at least 12
- Transparent tape rolls, at least 6
- Alka-Seltzer Original tablets, at least 6
- Water, at least 2 cups

Preparation

- Check with the classroom teacher about projection capabilities. In some cases, it may be easiest for you to send the video link to the teacher in advance. In other cases, you may be able to easily connect your laptop.
- Connect with the teacher ahead of time to copy all handouts.
- Take a moment to read through the lesson directions, but don't worry about following all directions precisely. If student engagement leads you briefly in another direction, that's fine. Just make sure students are able to begin working on the Moon Tourism handout when there are at least 30 minutes left in class.
- Find a place outside where you will be able to safely launch your mini rockets. You will need a flat surface for the rocket launching, as well as an area at least two meters away where student bystanders can assemble.

Next Generation Science Standards: Three Dimensions

Science and Engineering Practices

Constructing Explanations and Designing Solutions

- Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

Disciplinary Core Ideas

ESS1.B: Earth and the Solar System

- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.

Crosscutting Concepts

Interdependence of Science, Engineering, and Technology

- Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems.

Standards for Technological Literacy:

Standard 17: Information and Communication Technologies

J. The design of a message is influenced by such factors as the intended audience, medium, purpose, and nature of the message.

K. The use of symbols, measurements and drawings promote clear communication by providing a common language to express ideas.

Math Standards

Expressions and Equations

CCSS.MATH.CONTENT.7.EE.B.4. Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

Procedure

1. **Warm-Up Activity:** Begin class by showing this [video](#). Before you start the video, explain that the clip features a new spacecraft that is designed to taxi people back and forth to the International Space Station. As they watch, instruct students to listen for details that make the spacecraft unique.
2. When the video is complete, ask the class to help you make a list of factors and descriptors that make the CST-100 Starliner unique. Keep this list on the board throughout the entire lesson.
3. Share that while the spacecraft that they saw in the video is intended to bring astronauts and eventually tourists to the International Space Station, the ultimate goal is to bring astronauts and then tourists to the Moon and beyond.
4. Explain that though NASA has not sent a manned spacecraft to the Moon since 1972, six different crews have landed on the moon in the past. Each one took about three full days to travel the 238,900 miles to the Moon.
5. Write “238,900 miles” on the board, and then ask student pairs to calculate about how fast (in miles per hour) the spacecraft must have traveled on average to get to the moon in three days.
6. After a couple minutes, ask a student volunteer to explain how they arrived at their answer. Their explanation should resemble: If 3 days = 72 hours, then $238,900 \text{ miles} / 72 \text{ hours} = \text{about } 3,318 \text{ miles per hour}$.
7. Take a moment to explain that this speed is an average. In order to leave Earth, a spacecraft must take off at a speed of about 7 miles per second or 25,200 miles per hour to break free of Earth’s gravity. It then gradually slows down, and eventually must slow down enough to be captured by Moon’s gravity so it orbits around the moon and doesn’t fly right past it!
8. Tell the class that the circumference (or distance around) the moon is about 6,783 miles. Write this number on the board. Ask students to share everyday speeds that they are aware of. For instance, students may be able to run about 6 or 7 miles per hour, cars on a highway travel at about 65 miles per hour, and commercial planes travel at about 500 miles per hour.

Ask: If you wanted to be able to sightsee from your window, about how fast would you want to travel around the moon and how long would it take to travel around the moon at this speed? Give students a couple minutes to discuss and calculate before asking a couple partners to share their ideas. Accept multiple answers as long as students can justify their responses.

9. Then ask students: Considering the trip length possibilities and what you saw in the Starliner video, do you think Americans would be interested in traveling to the moon? Instruct students to demonstrate how interested they predict the American public would be by holding up between one finger (to illustrate very little interest) and ten fingers (to demonstrate a lot of interest).
10. Explain that students are now going to be challenged to change the public’s interest level to a ten! Place students in groups of three or four. Once the groups have been formed, explain that each group represents a Moon Tourism Agency. They will be working with their agency to create an advertisement that convinces Americans to sign up for the very first tourist trip to the Moon!
11. Pass out one Moon Tourism sheet to each group, as well as an Article Excerpts Sheet to each student. Explain that each “agency” needs to carefully read and follow the directions for Steps 1, 2, and 3. When they are ready for Step 3, the directions will tell them to raise their hand and you will give them an index card for their advertisement.

12. Subtract ten minutes from the amount of time left in class and tell students how much time they will have to complete their work. Then rotate throughout the classroom to make sure students are on task. Remember that groups will raise their hand when they are on Step 3 so you can give them an index card for their advertisement. Before you give them one, quickly review what they have completed for Steps 1 and 2 to make sure they are on the right track.
13. Give groups a five-minute and then a two-minute warning. As the students are finishing their advertisements, distribute one film canister and tape to each group.
14. Explain that each group will now create a simple rocket, adorned with the model advertisement that they just created! Instruct students to wrap their advertisement around the canister and secure it in place with the tape. Model how to do this by using this [image](#) as your guide. The cap of the film canister must be at one end of the paper tube!
15. Once every group has successfully taped their advertisement to the outside of their film canister, add water to each group's canister so it is about one-quarter full. Then lead the class outside to the rocket launch area and bring the Alka-Seltzer tablets with you.
16. For the last few minutes of class, encourage groups to briefly share their advertisements, including why they think this advertisement will work to convince the American public to travel to the Moon.
17. Then tell the class that there's no better way to convince people to travel to the moon than to create "buzz" and demonstrate what a trip to the moon might be like! Instruct one member from each group to bring their rocket to the rocket launch area. (The rest of the class should remain at least two meters away.) All students should have safety goggles on at all times.
18. Once you have the rocket-launchers assembled, distribute half an Alka-Seltzer tablet to each student. Explain that when you say "go," they should very quickly drop their tablet into the canister, snap the lid back on, place their rocket on the ground (lid down!), and then step away and join the rest of the class.
19. As soon as students have successfully done this, lead the class in counting backwards from 30 and watch as the rockets begin to launch. Most, if not all, of the rockets should take off long before zero is reached!
20. **Wrap-up:** Bring the class back inside. Before you leave, thank students for their participation and encourage them to keep an eye on the news to learn about developments in space travel. If they are interested, it's very likely that they could work in the field of Moon tourism—or even deep space tourism—after they graduate college!

Directions: Your group is in charge of a marketing campaign to convince Americans to be the first tourists to travel around the Moon! Follow the steps below to create a persuasive advertisement:

Step 1: Read and annotate the Article Excerpts: "How Boeing's Commercial CST-100 Starliner Spacecraft Works" Handout for additional details that you could use in your marketing campaign. In other words: What details in this article could be used to convince people to take a tourist trip to the moon?

Step 2: With a partner, discuss and fill out the chart below, based on what you have watched, read, and discussed:

Background Information: What details should passengers know before they decide to travel to the moon? Think about factors like trip length, safety features, etc.	Persuasive Information: What additional information may persuade passengers to give this a try? Think about factors that make this trip unlike any other!

Step 3: Raise your hand, and your group will be given an index card. You now need to combine your ideas and create an advertisement for Moon tourism.

Your ad must include (through pictures or words):

1. The name of this Moon expedition
2. The length of the trip
3. Examples of what the tourist will experience aboard this inaugural flight
4. Convincing reasons why a tourist should sign up for this trip

You should be creative, but make sure the information is based off what you learned today.

Finish early? With your group, discuss: Who in the American public will your advertisement target? Where could the advertisement appear to reach this audience?

Article excerpts from **How Boeing's Commercial CST-100 Starliner Spacecraft Works** by Elizabeth Howell [space.com/41360-how-boeing-starliner-commercial-spacecraft-works.html](https://www.boeing.com/41360-how-boeing-starliner-commercial-spacecraft-works.html)

The Starliner is designed to fit up to seven astronauts, although the configuration could change depending on how much cargo the spacecraft would carry. The spacecraft even has wireless internet for crew communications and entertainment; the internet will also be useful when docking with the International Space Station, Boeing representatives have said.

Astronauts inside the spacecraft will wear Boeing blue spacesuits as they operate the controls. Boeing's astronaut wear includes Reebok-inspired shoes, gloves that can manipulate touch screens, and a lighter and less bulky spacesuit designed for launch and re-entry.

The Starliner has a diameter of 15 feet (4.5 meters); a length of 16.5 feet (5 m), which includes the service module; and a volume of about 390 cubic feet (11 cubic md).

Emergency escape systems

In an emergency, the Starliner will use abort engines developed by Aerojet Rocketdyne. Should something happen with the Atlas V rocket before or after the launch, the abort engines will fire and pull the astronauts away from the rocket. In some cases, the astronauts could also use zip lines to quickly move away from the rocket on the launch pad. The spacecraft is designed to make either a land or water landing; notably, its launchpad at Cape Canaveral is close to the Atlantic Ocean, so it's possible that the crew would end up there.

Like all astronaut crews, the people aboard Starliner will also have been extensively trained in emergency procedures. Astronauts spend a large amount of their training in simulators and in boardrooms, discussing emergencies and the best ways to deal with them. That way, if the unexpected arises during a flight, astronauts and their ground-support crews know what to do.

Landing system

The Starliner has a standout feature from SpaceX's Dragon and the Apollo spacecraft that brought astronauts to the moon; it is designed to land on solid ground, using large air bags. If an emergency takes place, though, the spacecraft can splash down in the ocean, just like Apollo and Dragon.