FUTURE U.

Energy Team Classroom Visit

Space

Celestial Discoveries

Overview

After learning about the qualities of other celestial bodies, the class will work together to create a list of celestial traits. Using these traits as a starting point and a Make-Your-Own Celestial Body handout as their guide, student groups will design their own new celestial body, create a GIF of its orbit, and write a short blog post detailing the discovery. Each student will then take on the role of a particular Boeing career and will consider how their position could be involved/impacted with the discovery of this new celestial body.

Objective

After learning about the characteristics of celestial bodies, students will collaborate to create their own.

STEM Topics

Earth Science, Technology, Engineering

Timing

45–60 minutes

Materials Needed

- Device with the ability to project
- Celestial Discovery video
- Create Your Own Celestial Body handout (two pages), 35 copies
- Career Overviews handout, 35 copies
- Playdough or modeling clay (several colors), enough for the class to share
- Roll of clear string and scissors, one
- Wooden clay sculpting tools, 15
- Smart phone with free GIF app such as GIF X, GIF Maker, or Giphy Cam, at least one

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, as well as to determine if students should be allowed to use their own phones to create their GIFs or whether you should use your device to help with this step.
- 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 Step 2 of the Make-Your-Own Celestial Body handout when there are at least 35 minutes left in class.

Next Generation Science Standards: Three Dimensions

Science and Engineering Practices

Developing and Using Models

- Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems

Disciplinary Core Ideas

ESS1.A: The Universe and Its Stars:

- Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.

Crosscutting Concepts

Scientific Knowledge Assumes an Order and Consistency in Natural Systems:

- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation

Standards for Technological Literacy

Standard 17: Information and Communication Technologies

H. Information and communication systems allow information to be transferred from human to human, human to machine, and machine to human.

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.

Procedure

1. **Warm-Up Activity:** Explain that today, students are going to create a new celestial body that has been discovered in our Milky Way Galaxy! But first, they're going to watch a video about a real celestial discovery. Distribute the Make-Your-Own Celestial Body handout and review Step 1. Explain that as students watch the video, they should record as many celestial traits as possible: In other words, how is this outer space discovery described and characterized?
   Then show this video.
2. As students are watching the video, write the following categories on the board or on a piece of chart paper: Types of Celestial Bodies, Composition, Orbit, Sun, Earth-Like Qualities.
3. When the video is complete, ask students to 1) Share what they wrote down and 2) Tell you which category it should be placed under. If it seems that a new category should be created, don't hesitate to create one.
4. Once students have finished sharing, brainstorm together what other words you could put in each of the categories. Possible categories include but are not limited to:

Types of Celestial Bodies • Planet • Dwarf planet • Moon • Comet • Star	**Orbit** • How long does it take to orbit its sun? • Does it orbit in a habitable zone?	**Composition** • Solid (minerals and metals) • Gas (hydrogen and helium)
Does the celestial body have any Earth-like qualities? • Small in size • Rocky surface • Habitable	**Sun** • It this celestial body close to its sun? • What are the characteristics of its sun?	**Other:** _______________

5. Direct students' attention back Create Your Own Celestial Body handout and read the directions that accompany Steps 2–5. (Note: You do not need to read all of the information included with each step…Just the 2–3 sentence step description!) Explain that each group will have about 35 minutes to brainstorm information about their planet, create a quick model and orbital GIF, and then write a brief blog post about the discovery. Be sure to also explain where students can find the modeling materials (clay or playdough, wooden clay sculpting tools, and string).

   Tip: Also use this time to share whether students will create their GIF using their own device or classroom tablet. If they will be using their own phone, explain which GIF software you recommend. If they will be using a classroom device, the app can be downloaded ahead of time. Suggested apps include GIPHY Cam, GIPHY Capture, and PicsArt Animator.

6. Have students count off by six, and direct students with the same numbers to work together. (For example, all “ones” will be a group; all “twos” will be a group, etc.) Students should find their group members and then immediately get started.
7. After about 20 minutes have passed, regain the class’s attention. Explain that as they write their posts, there is one more important feature that they must include: a quotation from a reputable source! Distribute a Career Overview handout to each student and review the directions. Answer any questions they have before you direct the students to continue working.
8. **Wrap Up:** When there are about five minutes left in the period, encourage volunteers to share their blog post with the class!

Create Your Own Celestial Body

STEP 1: As you watch the celestial discovery video, record characteristics of celestial bodies below. In other words: What descriptive words or measurements could be used to describe a celestial body?

STEP 2: The discovery of Proxima B is old news. You're about to create breaking news with your discovery of a brand-new celestial body! Answer the questions below to brainstorm ideas for your new celestial body. Then put all of your brainstorming together in Step #3.

Question 1: What type of celestial object will you be creating? (Circle one option below)

- Planet: Planets move in a fixed orbit around a star, have a round shape, and have cleared the neighborhood around its orbit (which means there are no objects in its way as it orbits its sun).
- Dwarf planet: Dwarf planets move in a fixed orbit around a star, have a round shape, but have *not* cleared the neighborhood around its orbit (which means there are objects in its way as it orbits its sun).
- Moon: Moons are a natural satellite, which means they are within a planet's gravitational pull and therefore revolve around it.
- Comet: Comets are a small piece of rock and ice that, when they get closer to a star, start to release gases.
- Star: Stars are huge balls of gas that create their own light and have a large gravitational pull.

Question 2: Stars give celestial bodies heat and light. Low mass stars only give off a little heat, but can last up to hundreds of billions of years. Solar type stars, like the Earth's Sun, give off more heat but don't live for as long. High mass stars give off the most heat but live the shortest: only about a million years.

Will your celestial body exist near a star? (circle one) Yes No If so, what kind? ____________

Question 3: What, if anything, does your celestial body orbit and how long does a full orbit take?

Question 4: What is the surface of your planet like?

Question 5: Does the atmosphere have enough oxygen to sustain life?

Question 6: Does your celestial body have any other important characteristics? (Be creative!)

Create Your Own Celestial Body

STEP 3: Create a small model of your celestial body. Think about how you can represent its composition (e.g. what it is like on the inside) as well as its surface features.

Tip: It may be helpful to start with a small ball for the core and then add layers from there. You can then cut into your model to show the different layers!

STEP 4: Use your model to create a GIF that demonstrates your celestial body's orbit. If your celestial body orbits another body, draw or model this as well so it can be included!

STEP 5: With your group, use your work from the previous steps to write a short blog post that announces and explains your discovery. Pretend that it will appear as a guest post on a science blog along with your GIF, so write for an audience who loves science!

Post Headline: ____

Career Overview

Directions:

1. Read through the career summaries below and select one that interests you. Then pretend to be a person with this career, and imagine what you might say about the celestial discovery. For example: How would this discovery impact your career? What might you be most excited about?

   ____

   ____

   ____

2. Share your quotation with your group.
3. Together, choose at least one quotation to incorporate into your group's blog post.

Autonomous Engineer: You help create autonomous technologies, which are systems (such as satellites) that are able to make decisions on their own without human intervention. The technologies you develop help scientists study celestial bodies from afar. The extreme nature of space makes it a perfect environment for autonomous technologies!

Aerospace Engineer: You design, create, modify and test aircrafts and satellites. You may also review aerospace proposals and designs to see if they are feasible and if they meet engineering and environmental criteria.

Astrophysicist: You study a combination of physics, mathematics and chemistry in order to understand the life and death of planets, galaxies, stars and other celestial bodies. You normally do your observations from afar using telescopes.

Robotics Technologist: You work with engineers to develop robotic systems aboard spacecrafts. Robots are often able to explore space in a cost effective and safer way, and you help make this possible.

Media Relations Specialist: You work closely with engineers ands scientists to share news and stories about advancements and discoveries. You hope to engage the public through overseeing news stories, as well as information spread to the public over the internet and other media sources.

Programmer Analysist: You help design, code and create computer applications and software that are used in outer space. The computer programs you work on could be used for satellites, unmanned space rovers and even human exploration.

Policy Expert: Space policy, which are the guidelines that govern space exploration, is controlled by different treaties and agreements. No single country owns or governs outer space! Policy experts will work to create agreements among the government, private businesses and other countries on all issues regarding space.

Human Factors Engineer: You work on developing exploration technology. As you develop this technology, your primary goal is to make sure the technology works for the humans who have to use it. Your job is always to put the astronaut first.

Citizen Astronaut

Overview

Students will investigate how using technology connects scientists, engineers, and citizens across the country and around the globe by contributing to an out-of-this-world citizen science project! Students will first explore the term "citizen scientist" and learn about the variety of important ways that they, as students, can contribute to the world of science. The facilitator will preview a few of NASA's citizen science projects before one is selected through a class-wide vote. Students will then take the first steps in contributing to this project and will wrap up by developing a plan that outlines how they will continue contributing to this project in the future.

Objective

After collaborating to explore different citizen science projects and begin one of their own, students will independently create an action plan to ensure they continue contributing to the project in the future.

STEM Topics

Science, Technology

Timing

45–60 minutes

Materials Needed

- Device with internet access and the ability to project
    - Note: At least one device will be needed. If the school has enough devices available for students to work in groups of three, two, or independently—even better!
- Citizen Astronaut Action Plan handouts, 35 copies

Preparation

- Check with the classroom teacher about projection capabilities.
  In some cases, it may be easiest for you to send the website link to the teacher in advance. In other cases, you may be able to easily connect your laptop.
- Check with the classroom teacher about device availability.
  Will there be one classroom device or will there be other devices available for students to use? Discussing this with the teacher ahead of time, if possible, may increase the likelihood that students will have devices to use.
- Familiarize yourself with NASA's Citizen Scientist Homepage and the gist of the projects below:
    - Aurosaurus
    - Backyard Worlds
    - CosmoQuest
    - Disk Detective
    - Measure and Map Our Galaxy
    - Stardust

- Connect with the teacher ahead of time to copy the handout.
- Take a moment to read through the lesson directions, but don't worry about following all directions precisely. Student engagement may lead you temporarily off-course, and that's okay! Just make sure you choose your class project by the time there are 25 minutes left in class.

Next Generation Science Standards

Dependent upon which citizen science project is selected

Standards for Technological Literacy

Standard 1: Scope of Technology
F. New products and systems can be developed to solve problems or to help do things that could not be done without the help of technology.

Standard 13: Assess the Impact of Products and Systems
F. Design and use instruments to gather data.
I. Interpret and evaluate the accuracy of the information obtained and determine if it is useful.

Standard 17: Information and Communication Technologies
H. Information and communication systems allow information to be transferred from human to human, human to machine, and machine to human.

Procedure

1. **Warm-Up Activity:** Tell students that you are going to read four statements. If or when they think one is true, they should stand up. Between statements, students should return to their seats.
    a. Environmentalists are collecting Stream Selfies—pictures of you and any stream you come across—to help them check the health of every stream in the country.
    b. NASA is asking kids and adults of all ages to help them sort through telescope and satellite imagery so they can learn more about Star formation.
    c. Scientists are calling all dog-owners to report back on games you play with your dog to help the world of science better understand the inner-workings of dogs' minds.
    d. At any point, *you*—even if you haven't graduated college, high school, or even middle school—could contribute to one of thousands of science projects…from your computer, from your home, and from your community.
2. Tell students that ALL of the statements were true! Each project is part of the citizen scientist movement. Ask: What comes to mind when you hear the term "Citizen Scientist"? What or who do you think a citizen scientist is? Ask students to discuss this with the person next to them.
3. After a couple minutes have passed, ask for volunteers to share their thoughts.
4. Look for commonalities among the students' answers and eventually explain that a citizen scientist is an individual—a child, a student, a teenager or an adult—who contributes their time to scientific research. These individuals don't need to have a formal science background in order to help perform important tasks in collaboration with scientists!

5. Ask: Why do you think citizen scientists are important? How could someone without a science background help scientists? Call on student volunteers for ideas. Help students arrive at an understanding that science relies on observation. The more people who can record observations and share data, the better! By having people around the world use technology to share their observations, scientists are able to accomplish much more than they ever could themselves!
6. Project NASA's Citizen Scientist Homepage and explain that NASA is just one of the many organizations that works with citizen scientists. Scroll through this page and explain that each of these projects is calling on everyday citizens to help with space-related investigations. Share that they will get to participate in one of these projects.
7. **If only one classroom device is available:** Tell students that as a class, you will learn more about a few of the projects before selecting one. Call on student volunteers to point out projects on NASA's homepage that look intriguing. Depending on the class' interests, spend 5–10 minutes clicking through to different projects to see what they entail. Hovering over the thumbnail image on the homepage will bring up a small description, and clicking on the thumbnail will bring you to the project's homepage.

   During your full-class investigation, try to explore at least a couple of the following projects (all of which are available via NASA's homepage), as these can be easily completed in a classroom setting:

   - Aurosaurus: "Did you see an aurora? Be part of a world-wide reporting system that will help us understand how activity on the sun will affect the Earth."
   - Backyard Worlds: "Undiscovered planets and other smaller celestial objects may lurk in the distant reaches of our solar system. Help us search for new objects beyond our planet."
   - CosmoQuest: "Help NASA analyze more than 1.5 million images taken by astronauts on the International Space Station! This is a task only a human like you can accomplish!"
   - Disk Detective: "Help us find where new planets are forming around distant stars using heat images from the Wide-Field Infrared Survey Explorer."
   - Measure and Map Our Galaxy: "We need your help looking through tens of thousands of images from the Spitzer Space Telescope. By telling us what you see in these infrared data, you will help scientists better understand how stars form."
   - Stardust: "In 2006, a capsule from the Stardust spacecraft returned to earth with samples taken from a comet's tail. Help us search through images to find the first pristine interstellar dust particles ever brought to Earth!"

   *Note: As science needs are always evolving, it's possible that one or more of these projects no longer exists or may have changed requirements at different points in time. Continue on to another one of the many other available projects if this occurs!

   If enough devices are available for students to work in small groups, pairs or individually: Write the website URL on the board (science.nasa.gov/citizen scientists) and give students about 10 minutes to explore the different projects. Instruct students to look for one that sparks their interest as well as one that looks possible to complete in school. Remind students that they are not beginning a project at this moment; they are investigating their options.
8. When there are 25–30 minutes left in class, bring students back together. Create a list of projects that would be feasible to begin as a class. (If you are unsure, don't hesitate to click on the project's link

quickly and investigate together.) Once you have a list, instruct students to close their eyes and vote on the one that the class will complete together.

9. Then it's time to get started! Click on the project's link and spend about 15 minutes kicking off the citizen science project. If students have their own devices, they may follow along with you as you project. Some projects may ask you to register before you begin, others may have a short tutorial, and some may simply provide short instructions before you can get to work. Ask for student input through each step of the process, and allow students to take turns participating by using your device.
10. When there are just over 10 minutes left in class, wrap up what you are doing. Explain that while you are only there for one class period, this contribution to aerospace is something that the students can easily continue themselves. With the help of volunteers, like the students in this class, more and more scientific advancements can be made and at a faster pace then ever before.
11. Pass out the Citizen Astronaut Action Plan, and direct students to work independently or in pairs to create a plan for how they can continue to contribute to this science project beyond the end of the class period. It may be helpful to write the program's website and/or any log-in information you created on the board so students can copy it.
12. **Wrap Up:** When there are a couple minutes left in the period, ask students to share how they will continue contributing to this project. Then conclude by bringing their attention to the website on the bottom of the handout. Explain that in addition to continuing this project, there are countless others out there that also need their help. Students can use the website scistarter.com to search for additional projects that interest them!

Citizen Astronaut Action Plan

Name of the Citizen Science Project: ____

Website: ____

Log-in Information (if applicable): ____

Looking Ahead:

1. Think about what your class already accomplished. Then consider: How can you continue contributing to this citizen science project? (In other words: What has your class not yet completed? Or, what could you continue to do?)

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2. Where could you work on this citizen science project?

At home   At the library   Other: ____________________

3. How often can you commit to working on this citizen science project? Even a few minutes every few days will make a difference! Set a goal for yourself below:

Mondays	Tuesdays	Wednesdays	Thursdays	Fridays	Saturdays	Sundays
_____minutes	_____minutes	_____minutes	_____minutes	_____minutes	_____minutes	_____minutes

Interested in contributing to additional citizen science projects? Check out Scistarter.com: With a searchable database of over 2,700 different projects, it's a great place to start!

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!

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.

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 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 miles / 72 hours = about 3,318 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 *w* 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!

Moon Tourism: Marketing Campaign

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?

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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

Spacecraft Size and Astronauts

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.

Shades of Grey

Overview

After a discussion on how satellites work, students will use a photo mosaic to further understand how satellites collect information, break it down, and reassemble to deliver light images to Earth. For their final activity, students will work as partners to complete a grid art, where different shades are given a numerical value to create a picture representing the Boeing Tracking and Data Relay Satellite TDSR.

What do you need before you visit the classroom? (All of these are also listed in the activity.)

- Transparent 10X10 Grid, one per pair
- White Paper 10X10 Grid, one per pair
- Picture of Boeing satellite with strong contrasts, one per pair
- Numeric Shade Chart between 0–3, one per student
- Pencils

Preparation

- Review videos, maps, and reference links to familiarize yourself with their use.
- Check with the classroom teacher about projection capabilities. In some cases, it may be easiest for you to send the links to the teacher in advance. In other cases, you may be able to easily connect your laptop.
- Check with your classroom teacher about the best method for dividing students into pairs and have a plan for if there is an odd number of students.

What do you need to do when you get there?

- Introduce yourself to students once they arrive.
- Follow the procedures listed.

What can you do while students are working?

- Say hello! Ask them what excites them about STEM and what questions they may have about your career or satellite technology.
- Share a brief story! Students enjoy hearing stories about what you do for fun and what kinds of things you do at work.
- Be available for questions. Rotate to help where needed.