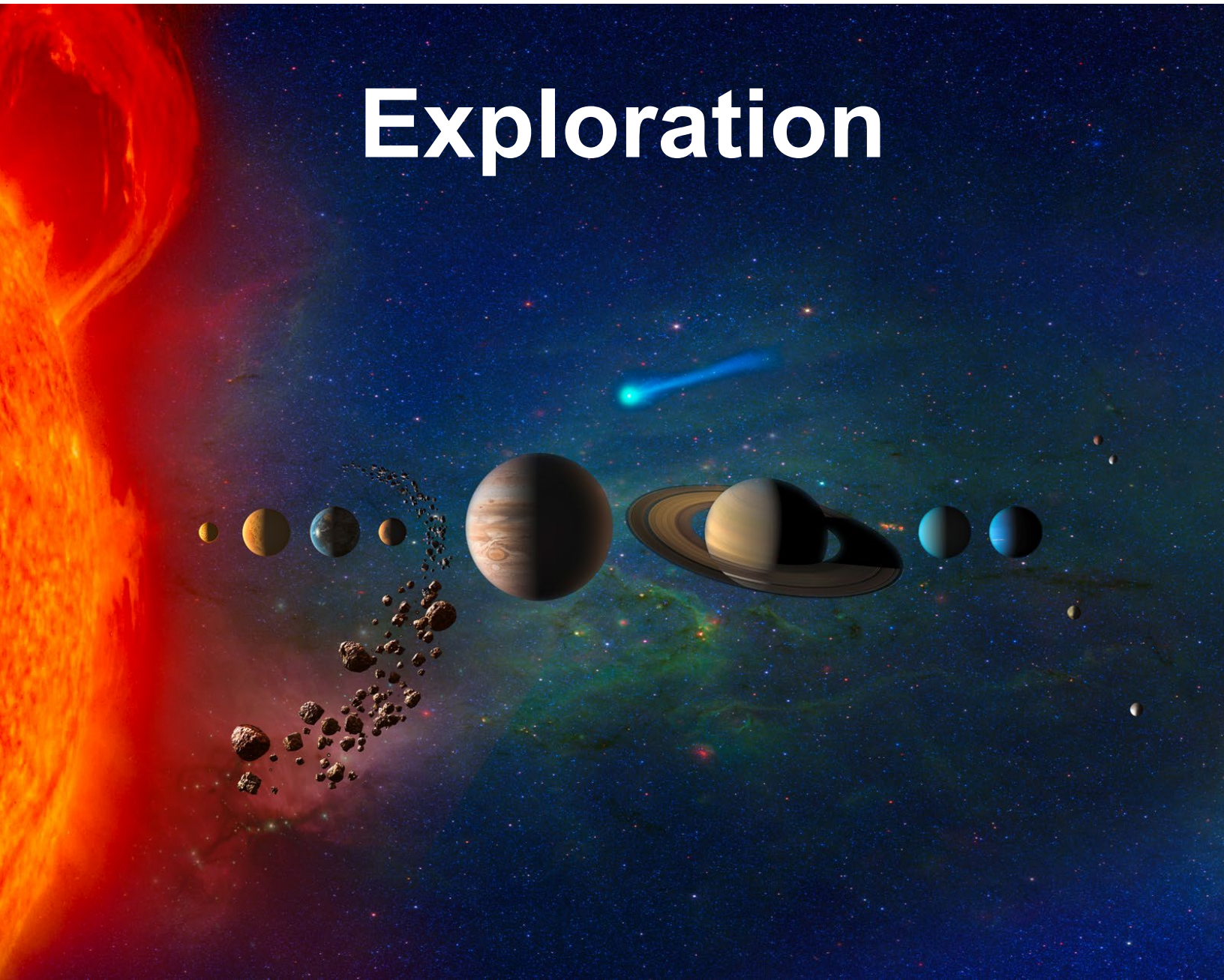


# Exploration



Source: [NASA](#)





# Our Solar System: Exploration

## Activity 1: Mission to the ISS

### Facilitator Notes

#### **Objective:**

Students will use an app to plan a mission to the International Space Station to become familiar with mission objectives, rocket assembly, the launch process, and docking with the ISS.

#### **Materials Needed:**

- Digital tablet
- App: "[Rocket Science: Ride to Station](#)"

#### **Summary of Student Action:**

Students will select a mission objective, assemble a commercial crew to meet the objective, build the rocket assembly, observe the launch sequence, and dock with the ISS.

#### **Setup Instructions:**

- Set up several tablets by installing and opening the app.
- Test the app to ensure it functions properly and you understand how to navigate through the entire process.

#### **Delivery:**

This activity is intended to be delivered in person. For virtual alternatives, explore the extension links in the implementation guide.



# Our Solar System: Exploration

## Activity 1: Mission to the ISS

### Student Instructions

#### Activate Your Knowledge:

What type of science experiments have been conducted on the International Space Station (ISS)? How are crew members selected? Which companies are working with NASA to transport astronauts to the ISS? How do crew members board the ISS?


#### Materials You Will Need:

Digital tablet

App: [“Rocket Science: Ride to Station”](#)

#### Procedures:

1. Touch the screen to start the program, press “New Game,” and choose a difficulty level.
2. Read about the two types of capsules you can choose from. Touch and drag the text to scroll through the Dossier. Choose one of the two options.
3. Read about the three mission options and choose one. Touch an “Empty Seat” to open the “Astronaut Selector.”
4. Choose astronauts with the skills required to complete the mission. You can read about their skills, education, and previous assignments.
5. Assemble your rocket by dragging the components into the correct position. You can learn more about each component by reading the text.
6. Click through the launch and separation sequence.
7. Dock with the space station by carefully adjusting the trajectory of the capsule.

NOTE: You can touch the  symbol on any screen to learn about that step of the process.



# Our Solar System: Exploration

## Activity 2: Design a Mission Patch

### Facilitator Notes

#### Objective:

Students will create a mission objective, name the mission, and design a mission patch.

#### Materials Needed:

- |   |   |
|---|---|
| <input type="checkbox"/> Paper                      | <input type="checkbox"/> Patch design template                    |
| <input type="checkbox"/> Pencils                    | <input type="checkbox"/> Markers, crayons, and/or colored pencils |
| <input type="checkbox"/> Images of previous patches |   |

#### Summary of Student Action:

Students will think of a goal and name for a future space mission. They will write out their goal and design a patch for the mission. They can read about previous missions for inspiration.

#### Setup Instructions:

- Display images of previous mission patches along with their descriptions.
- Print the design templates for students to use.
- Set out writing instruments and coloring utensils.

#### Delivery:

- This activity can be delivered in person or virtually. To deliver virtually, ensure students know to have paper available.
- Discuss previous missions and look over the list of previous patches before students begin designing their own.

#### Additional Notes:

- This activity can be done individually or in small groups. If delivering to small groups, you may want to have them develop competing designs for the same mission objective.
- Many centers have their own variation of this activity. Feel free to use your own instructions and templates, if you prefer.



# Our Solar System: Exploration

## Activity 2: Design a Mission Patch

### Student Instructions

#### Activate Your Knowledge:

Which space exploration missions have you heard of? What was the purpose of each mission? Which mission do you think was most interesting or influential? What do you think should be the goal for a future space exploration mission?

#### Materials You Will Need:

- |   |   |
|---|---|
| <input type="checkbox"/> Paper                      | <input type="checkbox"/> Patch design template                    |
| <input type="checkbox"/> Pencils                    | <input type="checkbox"/> Markers, crayons, and/or colored pencils |
| <input type="checkbox"/> Images of previous patches |   |

#### Procedures:

1. Read about previous space exploration missions and analyze their patches.
2. Use the provided template to establish the goal for a future mission.
3. Design a mission patch by using the templates and referencing previous mission patches. The design should reflect the objectives of your mission.
4. Write a summary to accompany the mission patch.



## Exploration - Activity 2 - Previous Mission Patches



### Project Apollo

The Project Apollo patch is a disk surrounded by a band with the words "Apollo" at the top and "NASA" at the bottom. The center of the disk contains the Orion constellation, which makes up the bar of a large letter "A." Earth is on the right of the letter, while the Moon is on the upper left. Apollo, the mythical Greek god of the Sun, is represented on the Moon. A double trajectory passes behind both spheres and through Orion.

Source: [NASA](#)



### Apollo 1

The patch for the first piloted Apollo flight shows a CSM (Command and Service Module) in Earth's orbit. The background contains stars and stripes of the US flag. The crew members' names appear within the inner border. The Moon, to the upper right of the spacecraft, is representative of the project's goal.

Source: [NASA](#)



### Apollo 7

On the Apollo 7 patch, a CSM circles the globe and trails an ellipse of orange flame. The navy-blue background represents the depth of space. The portion of Earth shown at the center of the patch, displays North and South America surrounded by the light blue of the oceans. The last names of the crew members are in an arc at the bottom. The Roman numeral, VII, representing the number of the mission, appears in the Pacific region of the globe.

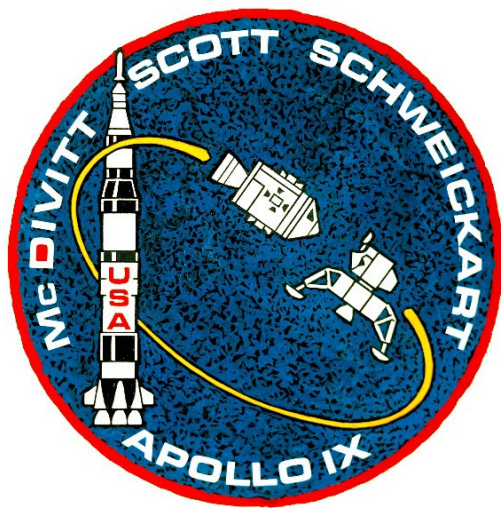
Source: [NASA](#)



Source: [NASA](https://www.nasa.gov)

## Apollo 8

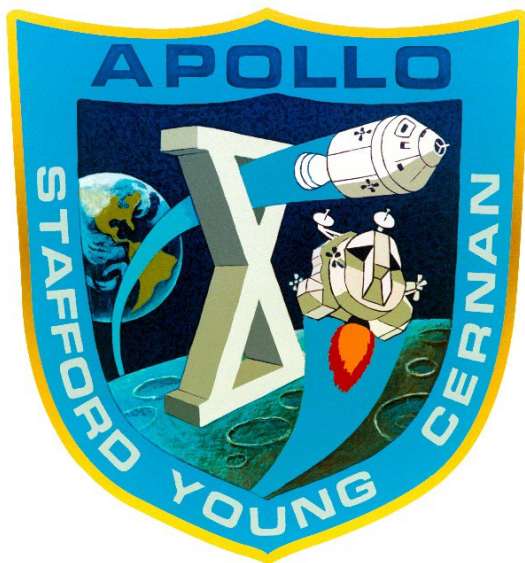
The shape of the Apollo 8 patch symbolizes the Apollo command module. The red figure eight that circles the Earth and Moon represents not only the number of the mission but also the trans-lunar and trans-earth trajectories.



Source: [NASA](https://www.nasa.gov)

## Apollo 9

The lunar module orbiting near the CSM on the Apollo 9 patch represents the first piloted flight of the spacecraft that would take humans to the Moon's surface. A Saturn V (launch vehicle) is at the left. The crew members' last names appear around the top of the badge, and the mission name is along the bottom. The "D" in McDivitt has a red interior to identify the mission as the "D" mission in the Apollo series.



Source: [NASA](https://www.nasa.gov)

## Apollo 10

The shield shape of the Apollo 10 patch is based more on mechanics than on mission goals. The three-dimension Roman numeral, X, identifying the mission number sits on the Moon's surface, while the CSM circles the Moon, and the LM makes a low pass over the surface with the Earth in the background. Although Apollo 10 did not land, the prominence of the X indicates that the mission made a significant contribution to the Apollo program.





## Apollo 11

On the Apollo 11 patch, a Bald Eagle, symbolic of the United States, is about to land on the Moon. An olive branch in its talons indicates that the crew “came in peace for all mankind.” At the top left is the Earth, the place the crew would return safely in order to fulfill President John F. Kennedy’s challenge to the nation. It is surrounded by black to represent the vast unknown of space.

Source: [NASA](#)



## Apollo 13

Apollo, the mythical Greek god, is represented by the Sun on the Apollo 13 patch. Three golden horses draw his chariot across the Moon, symbolizing how the Apollo flights have extended the light of knowledge to all mankind. The Latin phrase “Ex Luna, Scientia” means “From the Moon, Knowledge.”

Source: [NASA](#)



## Apollo 14

The Apollo 14 patch features the astronaut symbol approaching the Moon and leaving a trail from the liftoff point on Earth. The mission name appears in the top of the border and crew members’ last names appear along the bottom of the border.

Source: [NASA](#)





Source: [NASA](https://www.nasa.gov)

## Apollo 15

On the Apollo 15 patch, three stylized birds symbolize flight and the Apollo 15 crew. These three birds are over an artistic representation of the landing site, next to the Hadley Rille at the foot of the Lunar Apennines. To the right of the symbols, there is a representation of the Roman numeral, XV, on the Moon's surface, which represents the mission number.



Source: [NASA](https://www.nasa.gov)

## Apollo 16

The Apollo 16 patch features an American Bald Eagle perched atop a shield with a blue bar and the top and red and white stripes. Both figures rest on the Moon's surface and paid tribute to the American people. Crossing the shield while orbiting the Moon is a gold NASA vector. There are 16 stars on the border to represent the mission number. The crew members' last names also appear on the blue border, which is outlined in gold.



Source: [NASA](https://www.nasa.gov)

## Apollo 17

The Apollo 17 patch depicts the mythical Greek Sun god, Apollo. Behind his head is an American eagle. The red bars of its wing represent the bars in the US flag. The three white stars symbolize the three astronauts. The Moon, Saturn, and a spiral galaxy, rest on a black background. The eagle's wing overlaps a bit of the Moon to show that humans had been there. Apollo and the eagle are both facing the right side to imply that our goals in space would someday include the planets and, perhaps, the stars. Gold is a featured color in this emblem to symbolize the golden age of space flight.



SOURCE: [NASA](https://www.nasa.gov)

## STS-51-L

The STS-51-L patch was designed by Ernie Reyes at the request of the mission commander, Dick Scobee. This patch includes seven stars from the American flag, which symbolize the seven astronauts and the USA. It includes an Orbiter with a golden plume leading back to the launch site at the Kennedy Space Center in Florida. The Orbiter with open cargo doors represents the 51-L mission to launch a communication satellite meant to collect data from Comet Halley, which is shown streaking above the Orbiter. The apple to the right of the name "McAuliffe" symbolizes the education component of the mission, including the first teacher aboard a NASA shuttle mission. The patch is encircled with the last names of the seven crew members.



SOURCE: [NASA](https://www.nasa.gov)

## STS-135

The STS-135 patch represents the space shuttle, Atlantis, embarking on its mission to resupply the International Space Station. Atlantis is centered over elements of the NASA emblem in order to show how the space shuttle has been at the heart of NASA for the last 30 years. It also pays tribute to the entire NASA and contractor team that made all the incredible accomplishments of the space shuttle possible. Omega, the last letter in the Greek alphabet, recognizes this mission as the last flight of the Space Shuttle Program.



SOURCE: [NASA](#)

## STS-42 (IML-1)

The STS-42 IML-1 (International Microgravity Lab-1) patch shows the Orbiter with the Spacelab module aboard. The spacecraft has its tail-end facing Earth to best support the various microgravity payloads and experiments. Symbols representing Canada (the red maple leaf on the left of the border) and the European Space Agency (the "e" symbol on the right of the border) represent the international members of the crew. The number 42 is represented by six white stars. The single gold star above the Earth's horizon honors the memory of Captain Manley L. "Sonny" Carter: crewmate, colleague, and friend.



SOURCE: [NASA](#)

## STS-44

The STS-44 patch shows the space shuttle, Atlantis, ascending to orbit Earth to expand mankind's knowledge. The path, illustrated by the American flag, represents the American contribution and strength gained from this mission. The black background represents the mystery of space and is illuminated by six large stars. These larger stars depict the American crew of six and the hopes that traveled with them. The smaller stars represent the Americans who worked in support of this mission. Within the shuttle's payload bay is a Defense Support Program Satellite to help ensure peace. The stars of the flag symbolize our leadership in an exciting quest of space exploration and the boundless dreams of humanity's future.



# Mission Patch Design Template

MISSION NAME: \_\_\_\_\_

MISSION OBJECTIVE:

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CHOOSE A SHAPE:



DESIGN:

PATCH DESCRIPTION:

Use the space below to describe your insignia. Why did you choose this shape? Which symbols did you integrate into the design? What is the significance of the colors and symbols you chose? Describe the patch design and why each component is important.

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# Our Solar System: Exploration

## Activity 3: Space Telescopes – Hubble, Spitzer, and Webb Facilitator Notes

### Objective:

Student will watch videos and play games to learn about three space telescopes, with a primary focus on the James Webb Space Telescope.

### Materials Needed:

- Video: "[NASA's James Webb Space Telescope – Official Mission Trailer](#)"
- Video: "[Spitzer and NASA's 'Great Observatories' Space Telescopes](#)"
- Video: "[Hubble and Webb: A New Golden Age of Astronomy](#)"
- [Hubble Trivia](#)
- Game: "[Scope it Out](#)"
- Video: "[An Introduction to the James Webb Space Telescope Mission](#)"

### Summary of Student Action:

Students will learn about the design, development, and plans for the James Webb Space Telescope. They will watch videos about its predecessor, Spitzer, and its companion, Hubble. They will play a trivia game to learn facts about Hubble, as well as a game comparing the components of Hubble and Webb.

### Setup Instructions:

- Open all links in advance to ensure they work as expected.

### Delivery

- This activity is intended to be delivered virtually.
- You may choose to share your screen to watch the videos.
- This activity can be delivered in person by setting up a tablet for each resource.

### Additional Notes:

- Ask questions before each activity to engage the students' prior knowledge and set the stage for the content they will see in each.



# Our Solar System: Exploration

## Activity 4: SLS – To the Moon and Mars

### Facilitator Notes

#### Objective:

Students will watch videos to learn about the Artemis program and the future of space travel.

#### Materials Needed:

- |  |  |
|--|--|
| <input type="checkbox"/> Video: " <a href="#">Why the Moon?</a> "  | <input type="checkbox"/> Video: " <a href="#">No Small Steps Episode 4: Working with Gravity</a> " |
| <input type="checkbox"/> Game: " <a href="#">Rocket Builder</a> "  | <input type="checkbox"/> Video: " <a href="#">How We Are Going to the Moon</a> "                   |
| <input type="checkbox"/> Video: " <a href="#">Rocket Science in 60 Seconds: What Is the Space Launch System?</a> " |  |

#### Summary of Student Action:

Students will gain an understanding of the goals for upcoming missions to the moon and mars. They will explore the Space Launch System (SLS) to identify key components and how this technology will be used to transport humans into space. They will also learn that gravity is the fundamental force at work when planning missions in space.

#### Setup Instructions:

- Open all links in advance to ensure they work as expected.

#### Delivery

- This activity is intended to be delivered virtually.
- You may choose to share your screen to watch the videos.
- This activity can be delivered in person by setting up a tablet for each resource.

#### Additional Notes:

- Ask questions before each activity to engage the students' prior knowledge and set the stage for the content they will see in each.
- Additional resources are linked in the implementation guide, allowing students to explore these concepts in more depth.