

# Mission to Outer Space: Designing, Building, and Exploring with Planetary Rovers

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## **Introduction**

Greetings, fellow astronauts! NASA's Space Exploration Program has selected you and your team to assist in the design of a spaceship. Your goal is to help NASA make a decision about which planet or moon in the solar system to explore first. To begin, you need to do some research on your selected moon or planet in order to convince the NASA Officials that your selected destination is the most worthy site to explore. After you have selected a planet or moon and completed your research, your team must draw a design for a rover that will enable your team to explore the particular landscape of your chosen planet or moon. However, during the launch something unexpected happens to your navigation. Your rover will be placed on an unknown body (e.g.: planet, moon, asteroid) where you will need to collect data about that solar body using the video and probeware in order to determine where your out of control spacecraft has landed. Then you can send a message back to earth to retrieve your rover.

## **Objectives**

- Conduct internet research surrounding a body in the earth's solar system.
- Learn to use the PASCO and Vernier sensors to explore remote weather

conditions and geologic features (e.g.: magnetic anomalies, thermal vents)

- Design, build, and navigate a planetary rover
- Piece together clues from the planetary scenario to determine which solar body the rover has landed on.

### **Materials**

- Macintosh computer with Mac OS X
- Television Monitor
- Robotics Kit complete with video transceiver
- PASCO or Vernier Probeware
- Internet connection and Safari

### **Names of Team Members:**

1. Astronaut \_\_\_\_\_
2. Astronaut \_\_\_\_\_
3. Astronaut \_\_\_\_\_



### **Part I:**

#### **Mission to Outer Space**

To begin, you need to do some research on your selected moon or planet in order to convince the NASA Officials that your selected destination is the most worthy site to explore. Next, your team must draw a design for a rover that will enable your team to explore the particular landscape of your chosen planet or moon. Here are some tips and suggestions to help you complete this project:



**Task 1: Select a planet or the moon of a planet**

1. Talk to the members of your team to decide which planet or moon NASA should explore first.
2. To get some ideas:
  - a. Watch the video on the solar system.
  - b. Visit the web sites attached.
  - c. Use the software on the solar system.

**Doing Research: The following questions will help you prepare the best possible proposal.**

1. Write the name of your chosen solar body

here: \_\_\_\_\_

2. What two features do you find on your solar body that you can't find anywhere else in the solar system?



3. Is there oxygen in your solar body's atmosphere?

4. What are the gases that make up your chosen solar body's atmosphere—if it has any?

5. How cold and how hot does your solar body get?

6. Is there any water on your planet? What's the evidence?

7. Does your solar body have any moons? What are their names?

8. If you had a chance to live on any of your Solar body's moons, which one would you pick and why?

9. How wide and how deep is the biggest crater found on your Solar body?

10. If there is a crater, what do you think created such a large crater? Is there anything else that could have created a crater that big?

11. Does your Solar body have active volcanoes? If so, what evidence do scientists have that they exist?

12. Do you think that life will be found on your Solar body? Explain what you think using information gathered from your research.

13. You are going to be designing a model of a Solar body exploration rover in class. Using what you know about your Solar body' composition and atmosphere, what exactly would you like your rover to explore?

14. Why do you think it is important to explore your chosen Solar body?

15. Do you think NASA should explore your chosen Solar body or give those funds back to schools, hospitals, the homeless, or poorer countries than ours? Explain your answer.

16. Has anybody that comes from the same cultural background as yours led or participated in a shuttle mission to outer space. If so, please write the name of the astronaut or scientist below? [Maybe, you'll be the first if your project gets funded].

17. Write five different questions you would like your classmates to answer regarding your Solar body:

- a.
- b.
- c.
- d.

18. There is limited space in your ship, but NASA believes it is important that you bring something that would remind you of home, of your culture, and of who you are. Each member of your team is allowed to bring only ONE object. Write down what each team member would choose to bring on this long trip away from Earth and why:



**Task 2: Design a Rover**

Once your team has decided which planet or moon to explore, you will need design a rover that can function in the environment of the planet or moon chosen.

Note:

This is VERY important. For NASA officials to consider your rover design seriously you need to apply what you know about your planet or moon. Use the information your team gathered during your research to help design the best rover for your planet or moon.



Since the spaceship has already been built, and since there is a limited amount of money left to develop the rover, you can only select 12 items from the list below to build your rover.

Discuss with your team members the most important items to include in your design. Choose items that will help your rover to explore the unique features of your selected solar object.

- 1) Wide angle TV camera (to take pictures of the surface)
- 2) Seismograph (planet shake detector)

- 3) Thermometer
- 3) Storage area
- 4) Biological equipment (to detect life)
- 5) Radar (to examine the surface below any clouds)
- 6) Soil analyzer
- 7) Lightning rod
- 8) Wind speed detector
- 9) Robot (arm or other robot-like structure)
- 9) Computer
- 10) Magnetic compass
- 11) Telescope
- 12) Solar panels (for electricity)
- 13) Nuclear reactor (for electricity)
- 14) Rocket fuel
- 15) Attitude jets (small rockets for changing direction)
- 16) Geiger counter (for detecting radioactivity)
- 17) Radio telescope ("sees" radio waves)
- 18) Landing gear (for landing on hard surfaces)
- 19) Parachutes
- 20) Glider (for cruising through the atmosphere)
- 21) Cooling system
- 22) Heating system
- 23) Heat shield
- 24) Meteor shield (to protect ship from being hit by small rocks)
- 25) Radio transmitter and receiver (for communication with Earth)
- 26) Gas analyzers

27) Weapons

28) Other item not listed here that your group thinks is essential to explore the unique features of your solar object\_\_\_\_\_

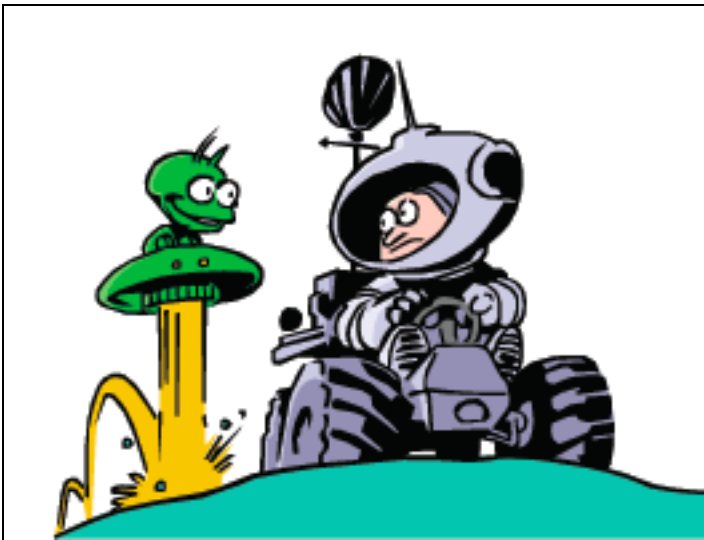
**→ Draw a picture of your rover design using a large piece of butcher paper and the 12 items your team chose. Make sure to label each item, and be ready to describe your design to the class.**

## Part II: Lost in Space ????

Your ship is out of control!!! Soon after taking off, a huge solar flare hit the Earth. Your ship is spinning into outer space, and you can't tell what's up or down any more. Smoke is coming out of your control panels as flashes of light blind you.

You and your team members wake up, and you are not sure where you are anymore. Your sensors are fried, and you can't contact NASA for help.

One of your team members looks through the cockpit window and points out that your ship is caught in the gravitational pull of a solar object. You can't tell if it is a planet, a moon or some other solar object far from earth. What



are you going to do??? How are you going to contact NASA for help???

Your team decides to start making repairs to the spaceship controls and radio right away, but you know that this is going to take some time, and you still don't know

Where you are. Therefore, you decide to send a rover to explore the surface of the solar object in hopes that you could identify it. Then, when

the radio is repaired, you can tell NASA where you are.

Once the rover gets to the solar object, you will be able to maneuver it using the remote controls. You will be able to see what the rover "sees" thanks to the video camera on the rover. You really need to be on your toes and stay sharp. You don't know what you will find or how long your rover will last. . .

→ **Use what you learned about the planets to identify the solar object.**

**Discuss your opinion with members of the team, and then write the name of the solar object and your reasons for this choice (If there is disagreement among your team members, that's OK. Write both responses and why you disagree with your team members' choice):**

## **Conclusion**

SO, WHAT'S NEXT?

Congratulations! You completed your tasks and you were able to contact NASA. Another space ship was able to assist you with repairs, and you're now free to continue exploring the solar system. . .

Do you want to know more about other astronauts?

Do you want to learn about robotics?

Do you want to know how to build your own rover at home?

Do you want to read a story about how high school students built a rover and won a top prize in a national competition?

Explore the resources indicated below.

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