MARS ROVERS

BIG IDEAS:

- Teams of scientists and engineers use rovers and other robotic vehicles to explore distant worlds.
- Rover missions, like those to Mars, are carefully planned here on Earth.
- NASA missions require large teams of people working together.

AUDIENCE:

- Families
- Students, 3rd grade and up

WHAT YOU NEED:

- Open floor space free of furniture or obstacles
- 30 9” x 12” sheets of red paper, cardstock, or felt
- 3 large beanbags or similar items to represent rock samples
- Small whiteboard and dry-erase marker, or clipboard, pencil, and blank sheets of paper
- Masking tape (optional)
- Blindfold (optional)
- Mars Rover floor map
- Activity Guide (English | Spanish)
- *Mission Control* info sheet (English | Spanish)
- *Design Your Own Mars Rover* drawing sheets and pencils (optional, 1 per participant) (English | Spanish)
- Table sign (optional) (English | Spanish)

SET-UP:

- Watch the Activity Training Video and Content Training Video to familiarize yourself with the activity.
- Set up the rover course with the red felt or paper tiles as obstacles and the beanbags as rock samples. You can follow the Mars Rover Map example sheet or design it in any way that accommodates the space you have. The difficulty of the course may be adjusted by adding or minimizing the number of turns for the Rover to make. Easier courses require

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fewer turns. The felt tiles work best on a carpeted surface. If you're doing this activity on linoleum or another hard surface, tape down or otherwise secure the tiles.

- **Safety considerations:** Remove or block off any obstacles that could cause a participant to trip or cause harm. Using the blindfold in this activity means participants should be closely monitored. You may choose to skip the blindfold and either have participants playing the part of the Rover close their eyes or just listen to the commands.

WHAT TO DO:

1. Ask participants to brainstorm ideas about how to control a robotic vehicle on another planet (such as the Perseverance rover on Mars) Remind participants that while rovers are a little like a remote-control car, rover drivers cannot actually use a joystick to direct the rovers. It takes between 4–24 minutes for our data signal to reach Mars. So, instead, the mission team creates a series of commands and then bundles and sends them up to the rover.
2. Assign one participant (or two participants, for a larger group) to be Mission Control. Explain that their job is to write the series of commands that will navigate the rover to pick up the rock samples (beanbags) without hitting any obstacles (red tiles). Give them the command board (whiteboard and marker). Invite them to carefully walk the obstacle course and write down the commands using these symbols:
   - Arrow = one step in the direction of the arrow
   - Circle = bend down and sweep the floor with your hands to find a sample.

   So, for example: →→↑• means two steps right, one step forward, bend and sweep.
3. The remaining participants will be the Rover. While Mission Control is walking the obstacle course, invite the Rovers to think about how they would design their own rover. You can use the *Design Your Own Mars Rover* drawing sheets or just have them discuss what type of instrumentation they think would be necessary to learn about Mars.
   - *What kinds of information could you collect? What tools would you need?*
   - *What might your rover-collected data reveal about Mars?*
   - *Why do you think this would be important?*
4. Once Mission Control has recorded their sequences on their command board, the Rover can begin. Have the Rovers line up at the starting line, holding the shoulders of the person in front of them for stability, and blindfold them to prevent them from aiding Mission Control during the command execution. If participants don't wish to use a blindfold, ask them to close their eyes.
5. The Rover will proceed along the course by following Mission Control's verbal commands. Remember: the commands cannot be changed from the original commands

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that Mission Control planned. They must be followed exactly. During real robotic missions, the commands are sent all at once. Any changes have to be made in another uplink of commands later.

6. Remind the participants that accuracy, not speed, is most important in operating a planetary rover. No one will be on Mars to help the rover if it gets stuck. It could take months of planning to back a rover out of a sand dune or away from a crater's edge.
7. If the participants are not successful in completing the course, Mission Control can try to save the Rover by creating a new sequence on their Command Board beginning from the place the Rover was "stranded." While Mission Control builds the new sequence, have participants discuss the repercussions of sending incorrect directions to a rover on Mars.
    - *What sort of obstacles exist on Mars?*
    - *Which ones could end a mission?*

TIPS & TRICKS:

- For young children, you could make some modifications such as setting up a shorter course, allowing them to keep their eyes open, and giving them a chance to start over if they make a mistake.
- If you are leading this activity in an out-of-school-time program or classroom setting, consider setting up multiple courses and dividing the class into smaller groups.
- For a similar activity that can be done on a tabletop, try the *Mission 2 Mars* Mars Rover Driver Board Game activity.
- See the Mission2Mars Additional Resources document for related videos, printable resources, and other activities.

WHAT TO KNOW:

- Mission control staff members are critical to ensuring the success of a space mission. They coordinate the launch, flight, and landing of missions involving spacecraft, satellites, space telescopes, and rovers. They also communicate new discoveries to the public and maintain the special equipment needed to support missions. NASA staff working in mission control are responsible for the safety and success of space missions, and team members with skills in science, project management, and engineering all make important contributions.
- No human has ever been to Mars. Mission Control at JPL has to base their actual commands on imagery taken by the rover or other data provided by NASA—they can't actually walk the course!

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- Because of many popular science fiction stories and the common use of the word “Martians” to describe fictional aliens, some participants may be under the impression that life has already been found on the red planet, but really no life has been discovered there (yet!)
- Some visitors may also come to the activity with the idea that Mars is red because it is hot. Try saying, “Yes, Mars is red, and that’s because iron rich dust reacts with oxygen in the air, producing a red rust color on the surface of the planet. The sky appears red because storms carry the dust into the atmosphere.”

SOURCE: NISENet, Mars Rovers

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