DESIGN challenge

To execute a mini-simulation of a robotic mission with a goal to command a human-robot through a set course to retrieve a piece of lunar ice.

OBJECTIVE

To demonstrate an understanding of the Engineering Design Process while utilizing each stage to successfully complete a team challenge.

PROCESS SKILLS

Mapping, communication, measuring, graphing, logical thinking

MATERIALS

Rulers or meter sticks

Blindfolds

"Prize" as lunar ice sample

STUDENT PAGES

Design Challenge

Ask, Imagine and Plan

Experiment and Record

PRE-ACTIVITY SET-UP

Set up a small obstacle course with a few chairs, waste paper baskets, and/or a table. The course does not have to be too complicated, but set it up so students will have to take at least one right turn and one left turn. Also, give the students enough obstacles so there is more than one path to take to the "finish". An area of about 25 square meters is recommended.

Please note: This activity will require two 60-90 minute sessions to complete. Make sure to set up the obstacle course exactly the same for both sessions. Also, the student acting as the robot will need to be blindfolded for this activity. Please take time to discuss with your students about assisting or "spotting" their blindfolded peer.

MOTIVATE

- Explain to the students that many of NASA's missions are conducted by robots. Ask students to draw their ideas of what a robot looks like and compare the differences.

SET THE STAGE:

ASK IMAGINE
& PLAN

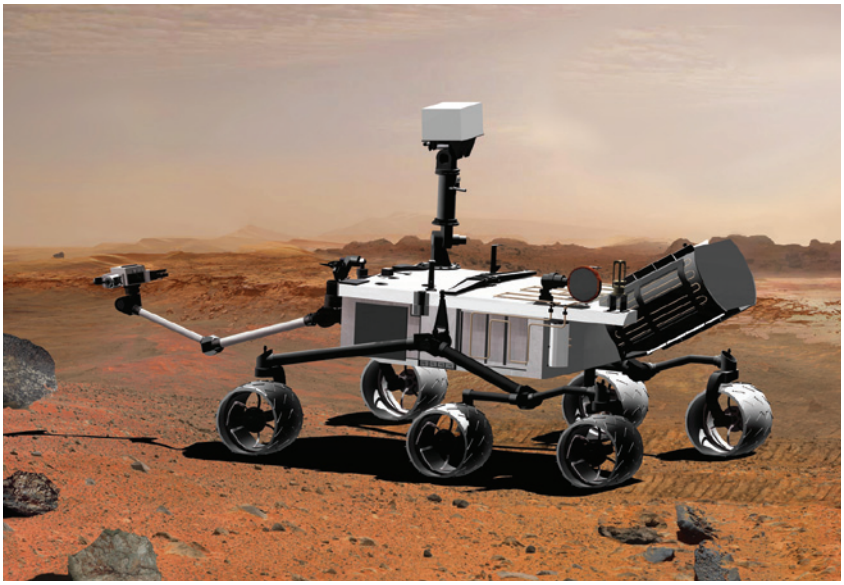
- Share the *Design Challenge* with the students.
- Students must draw their chosen course on the map and include at least one right turn and one left turn. Map should be approved before proceeding to next step.
- Let students practice commands to use with their robot. These commands are simple words, plus a number for steps taken.

CREATE

- Students will identify the robot's route through the lunar landing site and count the number of steps needed for each command to calibrate the distance the robot travels on a given command. From this, a command sequence for their robot can be created, then tested on the planned route of their maps.

EXPERIMENT

- Student teams must navigate the lunar landing site, using the command sequence each team designed. Have students cut out the commands into strips of paper and designate one student per team to deliver each command. Designate another team member to run a stopwatch. Position the robots at the start and have the teams sitting or standing aside from the obstacle course. The students designated to deliver commands are to deliver one command at a time – one student walks to the robot, delivers one command, then returns to the team. Robot performs the command. The



next student then walks to the robot and delivers the command, returns, etc. Only one command is delivered at a time to represent one line of code sent over a radio signal. The rest of the team cannot deliver another command until they have determined if the robot has successfully executed that command. Have each team record how much time it takes to successfully complete the task when the robot picks up the "lunar ice".

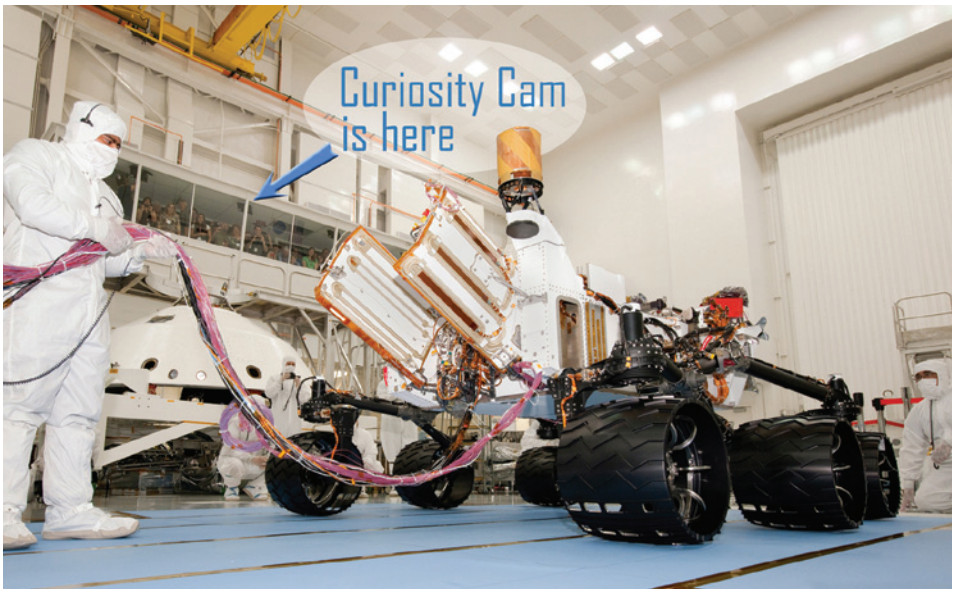
CHALLENGE CLOSURE

Engage students in the following questions:

- *Did each team pick the same route or were there several routes to get to the lunar ice? Which route worked the best?*
- *Why did you have to deliver each command separately? How does it relate to communicating with robots in space?*

PREVIEWING NEXT SESSION

Ask teams to think about how a spacecraft might land on the Moon safely. Ask them to think about why it does not make sense to use a parachute on the Moon. Answer: There is no air on the Moon to fill up the parachute.



DESIGN challenge

To execute a mini-simulation of a robotic mission with a goal to command a human-robot through a set course to retrieve a piece of lunar ice.