C5ISR Center Outreach STEM@Home

Welcome to STEM@Home!

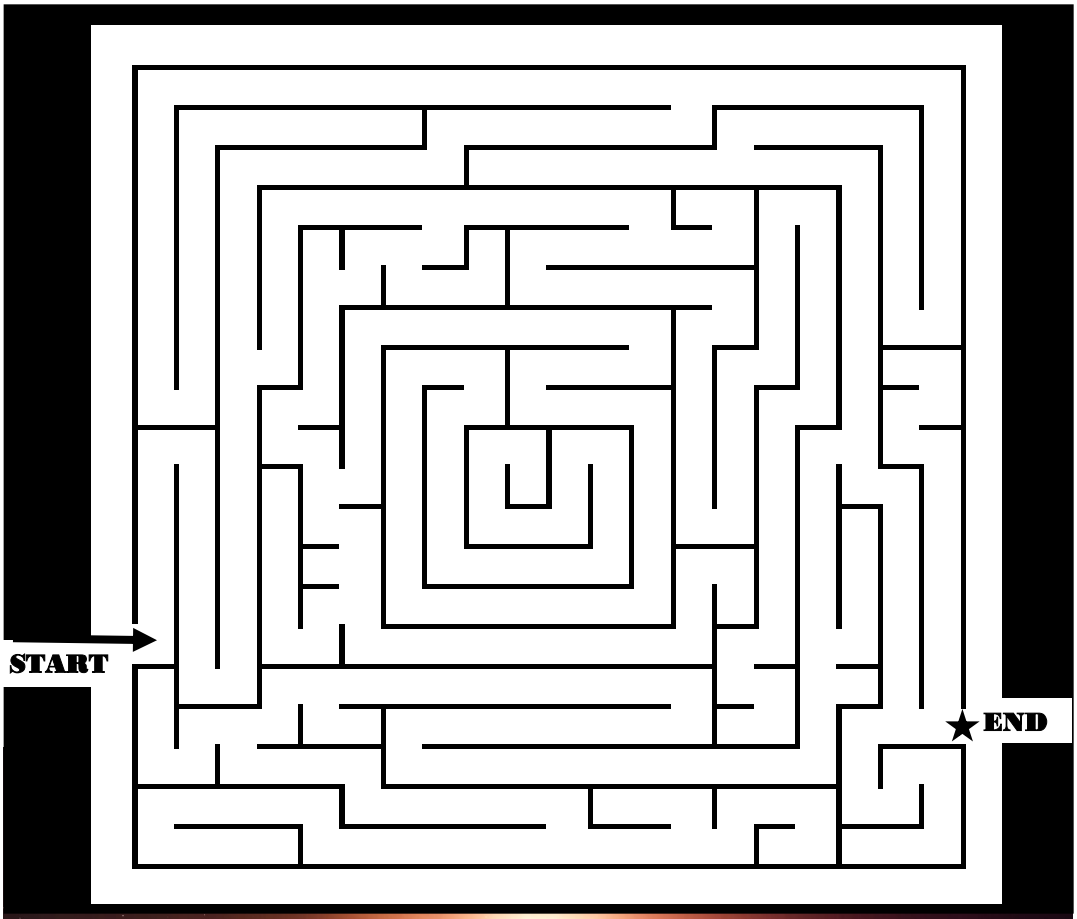
As we maneuver the challenges of the COVID-19 epidemic, we strive to continue to make STEM accessible to all.

The STEM@Home Newsletter is intended to be a resource for our C5ISR Center Family to provide engaging and educational activities that can be done with minimal materials and a whole lot of imagination.

In this Issue…

Issue 5

STEM Is Out of This World…



SHARE YOUR STEM…

Visit the C5ISR Center on Facebook to post a photo or video of your child completing one of the STEM@Home Activities.

https://www.facebook.com/CCDC.C5ISR/

#C5ISRCenterSTEM

Design a Robotic Vehicle (K-2)

What's it like in Outer Space?

NASA is a government agency responsible for exploring space. When NASA scientists wanted to understand what Mars is like, however, they used a "rover" to explore, because astronauts can't walk around on Mars. A rover is a vehicle designed to travel on the ground and explore. The Mars rover was used to make detailed observations about the planet Mars. Rovers are designed to explore, take pictures, and gather samples that can be used by NASA scientists to learn about faraway places. While NASA's Mars rover was sent to Mars without astronauts, what would it take to turn the Mars rover into a space vehicle to be driven by astronauts?

Mission: NASA is in need of a new robotic vehicle to use on Mars. The new vehicle, which you should name, must carry two astronauts, and be able to take pictures and gather samples.

Things to think about:

- **Gravity**, which is the force that keeps us on the ground, is weaker on Mars. How will you keep the vehicle from floating away?
- **Oxygen** is necessary for humans to breathe, but Mars does not have enough available oxygen. How will the astronauts breathe while in the vehicle?
- **Safety** is critical. What safety features will you include to keep the astronauts safe
- E**xploration** is the main reason for the mission to Mars. How will the vehicle let astronauts take pictures and collect samples?

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Design Process:

ASK: What is the problem you need to solve? (Design a new robotic vehicle to use on Mars.)
IMAGINE: Brainstorm and decide on one idea– What will your robotic vehicle be used for?
PLAN: Draw a picture of your vehicle. (What will your robotic vehicle look like?)
CREATE: Use the materials to create a model of your robotic vehicle.
IMPROVE: How can you improve your robotic vehicle?

Did you know?

NASA has sent 4 rovers to Mars over the years. Their names are Sojourner (1997), Spirit (2003), Opportunity (2003), and Curiosity (2011).

Materials:

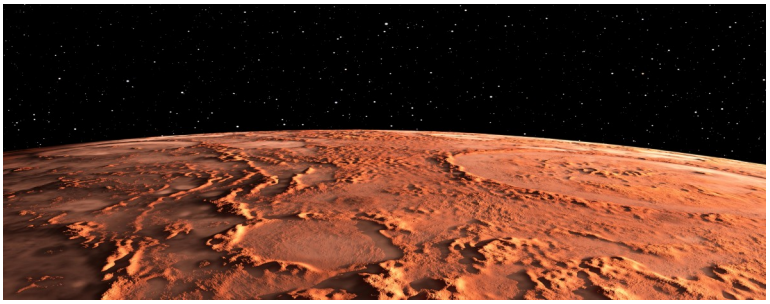
- Straws
- Foil
- Cardboard
- Tissue paper
- Craft sticks
- Straws
- Plastic bottle caps
- Markers
- Tape
- Glue

Questions to ask:

- What is the name of your robotic vehicle?
- If you had more choices of materials, what would you use and why?
- Why do you think it is important for scientists and engineers to use rovers on other planets?

Did you know?

Mars is called the Red Planet because there is a large amount of the chemical called iron oxide (also known as rust) in the planet's rocks and soil, which makes it appear red.



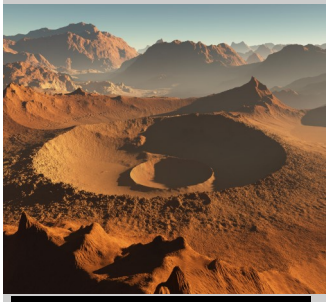
Asteroid Prevention Device (3-5)

Vocabulary:

Asteroid: Small rocky objects that orbit the sun.

Crater: Bowl-shaped depression or a hollowed-out area in the ground that is caused by an explosion or impact of an asteroid.

Diameter: Straight line passing from side to side through the center of a figure such as a circle.



Science Fact:

Over the past few billion years, there have been some asteroids that have hit the Earth. Impact craters and deformities in rocks show the evidence for these events structure near the crater and fragments from asteroids.

Beware the Slimocrepians

The Earth crosses the path of many comets and asteroids as it orbits. In recent history, there have been no major asteroid impacts on Earth (the last major impact took place in 1908 in Siberia, Russia), but scientists believe it's possible that sometime in the future, it could happen again. Engineers and scientists design and use satellites that orbit around other objects in space to observe and determine if there are asteroids which have the potential to impact earth.

Mission:

The Slimocrepians from planet Oobleck are planning to send big slimy asteroids to destroy Earth. These slimy asteroids are expected to form large craters on land and explode slimy liquid everywhere. The U.S. Asteroid Avoidance Task Force is asking for your assistance to understand how these slimy asteroids will impact Earth.

The experiment below will show the craters that could form when the Slimocrepians drop the slimy asteroids on Earth, and help you determine the impact.

Impact of Slimy Asteroid Experiment

Materials:

- Impact Tray- any clear plastic container
- "Earth"- sand, flour, salt or sugar
- 3 impacting objects: marble, golf ball, ping-pong ball, small bouncy ball. If you do not have any small balls you can make three different sized balls from tinfoil
- 12-inch ruler

Experiment:

1. Fill your container with either the sand, flour, salt, or sugar and smooth the material so that it is level.
2. Make a prediction of what you think will happen when you drop the slimy asteroids into the sand container.
3. Starting with smallest sized impact object, drop it into the impact tray from a height of about 2 feet. Use a ruler to measure the diameter of the new crater in mm and record it on a piece of paper.
4. Smooth out the material in your impact tray and repeat Step 3 with the other 2 impacting objects.
5. Clear your impact tray and drop all three of your impact objects at a height of about 4 feet. Use a ruler to measure the diameter of the crater from each drop. Record your data on a separate piece of paper.
6. Take a moment to analyze your data.
   - Which impact object made the largest crater? Why?
   - Did the height from which you dropped the object make a difference?

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Spacecraft Design (6-8)

Vocabulary:

Gravity: A force between two objects that keeps you on the ground instead of floating in the air.

Drag: A force acting opposite to the relative motion of any object moving through the air.

Force: A push or a pull on an object resulting from that object's interactions with its surroundings.

Materials List:

Materials	Cost
Water bottle	$200
Any type of paper	$60 per sheet
Tape	$45 for 12 inches
Glue	$50
Popsicle sticks	$65 for 15
Straws	$40 for 8
Cardboard	$185
String	$75 for 24 inches
Inside of paper towel roll	$100
Toothpicks	$180
Paper cup	$200
2 cups the same size	$220
Rubber bands	$25 each
Material item of choice (not listed)	$250

Failure is Not an Option

It takes a large team of scientists and engineers to support space travel. Apollo 11 was the first manned spacecraft to land on the moon on July 20, 1969. The last time American astronauts went to the moon was in 1972, but recently, NASA has announced a new project called Artemis that will take American astronauts back to the moon.

Mission: You have been hired as an engineer by NASA to design a spacecraft that can land on the moon while protecting the astronauts inside.

Things to think about:

- When a spacecraft lands on the moon, it will experience different forces of gravity and drag.
- A spacecraft with a larger surface area will experience a greater drag force when landing on the moon. Example: If you put your hand out of a car window and open your palm you will experience a greater drag force from the air.

Requirements for your Design:

- Your spacecraft must be within a budget of $1,000.
- Your spacecraft must be designed to keep astronauts safe.

Design Process:

ASK: What is the problem you need to solve? (Design a spacecraft to land on the moon while protecting the astronauts inside and stay within a $1,000 budget.)

IMAGINE: Brainstorm and decide on one idea – How will your spacecraft keep the astronauts safe?

PLAN: Draw a picture of your vehicle. (What will your spacecraft look like?)

CREATE: Use the materials to create a prototype within the $1,000 dollar budget. (Use the cost list to determine how much the spacecraft will cost.)

IMPROVE: How can you improve your spacecraft?

Questions to ask:

- What is the name of your spacecraft?
- If you had more choices of materials, what would you use and why?
- Why do you think it is important for scientists and engineers to use rovers on other planets?

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Design a Landing Device (Grade 9-12)

Vocabulary:

Air Resistance: Also known as a drag is the force of friction caused by the surrounding air.

Shock Absorption: Something that absorbs the force of impact, like springs in a mattress.

Decelerator: Mass or object which decreases the speed of another object.

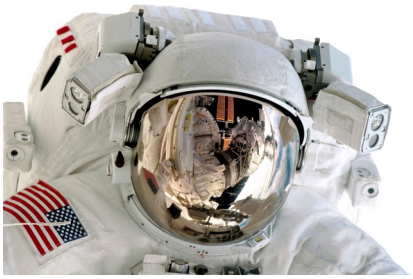
Materials:

- 2 hard-boiled eggs (ask permission from an adult before boiling eggs)
- 10-inch balloons
- Craft sticks
- Rubber bands
- Tape
- Bubble wrap
- Newspaper
- String
- Plastic bags

Coming In for a Landing

Spacecraft must travel at extremely high speeds to reach Mars, and it is important that they have a "drag device" to slow them down before landing on a planet. Beginning in 1976, NASA has used a parachute design as a drag device to land rovers safely on Mars.

Mission: NASA has recruited your help to design a new landing device - something other than a parachute - that will help to decelerate the spacecraft and land a rover safely on Mars.



Requirements:
Your hard-boiled eggs will represent a land rover. Your landing device must be able to land the eggs safely from at least a 4-foot drop.

Design Process:
ASK: What is the problem you need to solve? (Design a landing device that will help rovers land safely on Mars).
IMAGINE: Brainstorm and decide on one idea - How will the landing device work? How will you construct a frame to secure the rover (egg)? What will you use to cushion the egg?
PLAN: Draw a picture of your invention. Label the picture with the materials you intend to use.
CREATE: Use the materials to create your prototype.
IMPROVE: Test your invention

- Use the hard-boiled eggs to test your landing device system by attaching your landing device to the egg and dropping it from a height of at least 4-feet.

Questions to think about:

- How did testing help you decide what changes you should make to your landing device?
- What are the advantages of your landing device?
- Why is it more likely for the egg to break if you drop it from a greater height?

Standards: C5ISR Center STEM Outreach Activities Align with the Next Generation Science Standards/ Common Core Math Standards:

ACTIVITY ONE: K-2-ETS1-1 Engineering Design: Ask question, make observations and gather information about a situation that people want to change to define a simple problem that can be solved through development of a new improved object or tool. K-2-ETS1-2. Develop a simple sketch, drawing or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

ACTIVITY TWO: MS-ETS1-1 Engineering Design: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. CCSS.MATH.CONTENT.7.G.A.1: Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

ACTIVITY THREE: 3-5-ETS1-3 Engineering Design: Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. 3-5-ETS1-1 Engineering Design. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

ACTIVITY FOUR: HS-ETS 1-2 Engineering Design: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.