# C5ISR CENTER 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.

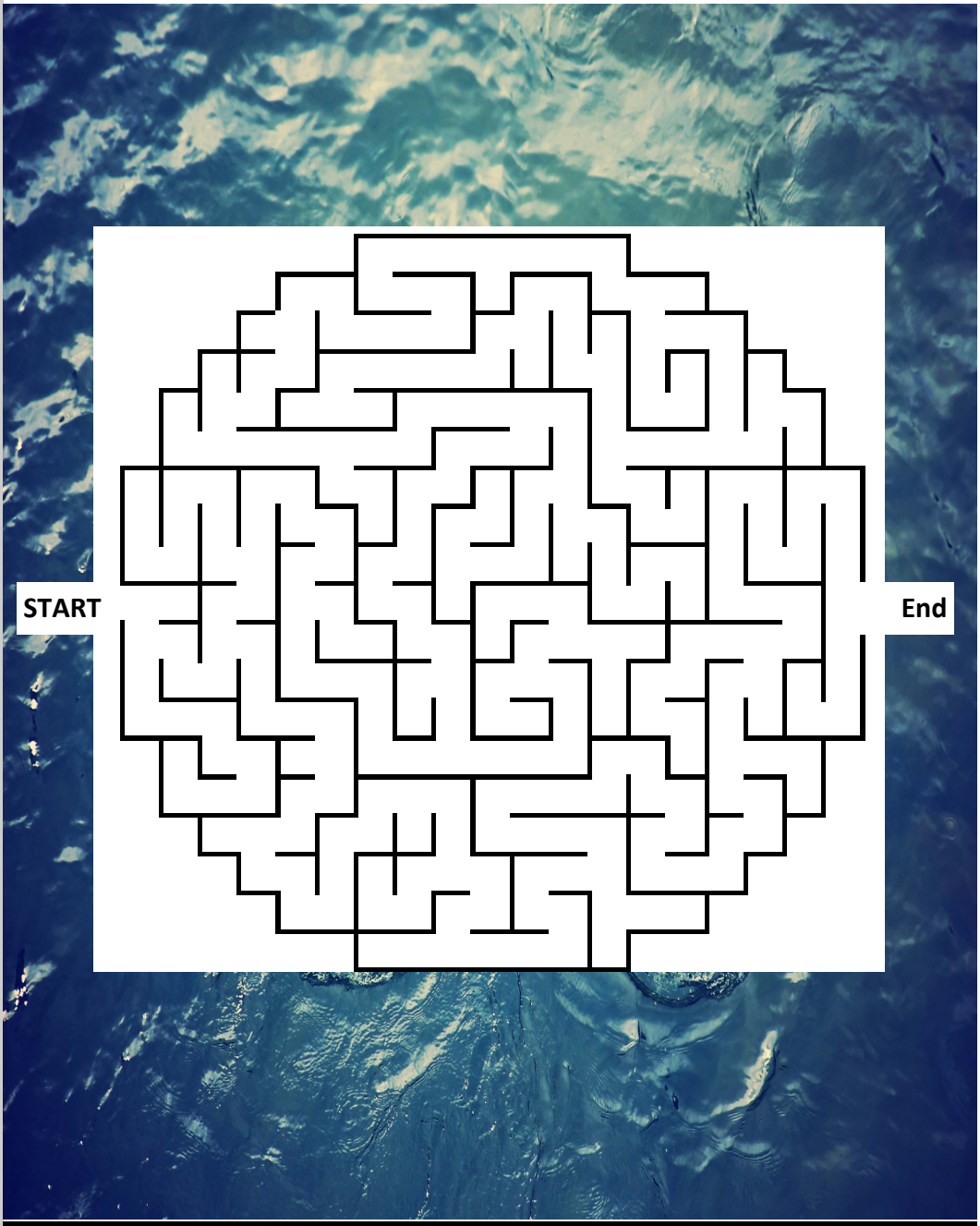
The STEM@Home Newsletter is intended to be a resource to provide engaging and educational activities that can be done with minimal materials and a whole lot of imagination.

**In this Issue…**



**Issue 10**

## Just Keep Swimming Maze Challenge




## 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/

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# Rescuing Ocean Animals Challenge (Grades K-2)

**Things to think about:**

The rescue device will need to be something that can safely grab and secure a marine animal from the ocean. Your device should have something to keep the animal secure – such as a strap – that will prevent the animal from getting out. It should also be waterproof.

**Materials:**

- Popsicle sticks
- Straw
- Paper or cardstock
- Piece of cardboard
- Paper towel roll tubes
- Plastic cups
- Aluminum foil
- Empty water bottles
- Tape
- String or rubber bands
- Fabric
- Paper towel or tissue
- Index card

**Materials to test with:**

- Small toy to place on rescue device, or you can draw/cut out a picture of an ocean animal that you would like to rescue
- Paper
- Markers or crayons
- Scissors

## Hanging Out Under the Sea...

Have you ever wished you could spend the day under the ocean swimming with the fish and the dolphins? If so, you might have an interest in marine biology.

A marine biologist studies anything that lives in oceans and makes discoveries about life there, from the tiny plants that live on the ocean floor to the largest whales swimming in the deep. One of the most important jobs of a marine biologist is to work with marine animal rescuers to help save and treat injured or sick marine animals with the goal of returning them to their ocean homes. Marine biologists and volunteers who work for marine wildlife rescue organizations use large boats and tools – such as large nets and slings that look like hammocks, and cages – to help them rescue aquatic animals.

**Mission:** Marine Life Rescue has hired you as an engineer to support their mission of rescuing injured or sick mammals such as dolphins, whales, and seals with the ultimate goal of nursing them back to health and returning them to their original home. You are being asked to design a new and improved rescue device that will assist in lifting the animals out of the ocean.

**Design Process**

- **ASK**: What is the problem you need to solve? Design a rescue device to support the goal of rescuing an injured or sick animal from the ocean.
- **IMAGINE**: Brainstorm and decide on one idea. What will your rescue device look like?
- **PLAN**: Draw a picture of your rescue device.
- **CREATE:** Use the materials to create a prototype of your rescue boat or device.
- **IMPROVE:** Think of ways you could improve your invention. Test your rescue device by placing a small toy in the rescue device to ensure it is secure when trying to lift it off the floor.

*You can draw or cut out a picture of your favorite ocean animal and use that to test your rescue device.

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**Questions to think about:**

· Were you successful in designing a recue boat or device that will rescue ocean animals?
· If you had access to additional materials, what would you have used? Why?

# Device to Clean the Ocean (Grades 3-5)

**Materials:**

- Popsicle sticks
- Straw
- Paper, cardstock, or index cards
- Piece of cardboard
- Paper towel roll tubes
- Plastic cups
- Aluminum foil
- Empty water bottles
- Tape
- String or rubber bands
- Fabric
- Paper towel or tissue
- Plastic spoons
- Glue
- Paper plates
- Any other small item you have in your home

**Things to think about:**

If you're creating a device that will remove trash from the surface of the ocean, will your device stay in place or move around?

If you're creating a device that will remove trash found deep in the ocean, you will need to think about how your device will descend and how it will run.

## It's Clean Up Time...

What is the problem with plastic?

The amount of plastic in the world's oceans is a continuing issue for humans and animals alike. Every year, eight million metric tons of plastic goes into the ocean. An average of more than 269,000 tons of plastic debris floats on the surface, while billions of other plastic microfibers litter the deep sea. Plastic pollution can poison the water, causing marine animals to die. One technology that has been designed to help reduce this problem is called the Ocean Cleanup, which is a U-shaped net-like device that hangs below the surface of the water and moves with the natural current, collecting plastics that float by. The combination of natural forces and a sea anchor create a drag, which makes the cleanup system move slower than the plastic, allowing the trash to be captured. Engineers and scientists are continuing to research and design new technologies to reduce plastic pollution in the ocean without harming marine life.

**Mission:** You have been hired as an engineer for the Marine Life Protection Agency to design a new device or tool that will remove plastic pollution from the oceans. You have been asked to focus on creating a device that will remove trash found deep in the ocean or on the surface.

**Requirements:**

Using materials that you find in your own home, create a device or tool that can remove trash from either the surface of the ocean or deep within the ocean.

**Design Process**

- **ASK**: What is the problem you need to solve? Design a device or tool that will be able to remove trash from the surface of the ocean or remove trash found deep in the ocean.
- **IMAGINE**: Brainstorm and decide on one idea. What will your device look like, and how will it work?
- **PLAN**: Draw a picture of your device or tool. Label the picture with the materials you intend to use.
- **CREATE:** Use the materials you find in your own home to create a prototype of your device or tool.
- **IMPROVE:** Think of ways you could improve your device.

**Questions to think about:**

- Did you succeed in designing a device or tool that can remove trash from deep in the ocean or on the surface?
- If you had access to additional materials, what would you have used? Why?
- If you had to do it all over again, would your design change?

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# Submarine Challenge (Grades 6-8)

## Deep Dive!

What does a submarine do? A submarine is a vessel or ship that can go underwater. Submarines used by the military are very large and can carry more than 100 people. Scientific researchers, explorers, and engineers use smaller submarines to explore under the ocean. These submarines may have cameras, mechanical arms, and other tools that will help scientists study the ocean. Like other ships, a submarine can float because the pressure of the submarine pressing down on the water is the same as the pressure of water pushing up on the ship. A submarine is different from other ships because it can control its buoyancy. To control buoyancy, a submarine uses special tanks that can be filled with water or air. When a submarine dives down into the ocean, air is released through a vent, and the tanks are flooded with water. This makes the submarine denser than the surrounding water, which causes it to sink. To return to the surface, the tanks dump out the water and are filled with air. This makes the submarine less dense than the surrounding water, causing the submarine to float to the surface.

**Mission:** Deep Dive Water Transportation has contracted you as an engineer to design a new and improved submarine for scientific researchers to study deep down in the ocean.

**Requirements:** Test your prototype of the submarine to ensure it can float on the water's surface as well as submerge under water.

### Design Process

- **ASK**: What is the problem you need to solve? Design a prototype of a submarine that can float and submerge under water.
- **IMAGINE**: Brainstorm and decide on one idea. - What will your submarine look like?
- **PLAN**: Draw a picture of the prototype of your submarine. Label the picture with the materials you intend to use.
- **CREATE:** Use the materials to build a porotype of your submarine.
- **IMPROVE:** Think of ways you could improve your submarine.

### Questions to think about:

- Did you succeed in designing a protype of a submarine that can float and submerge under water?
- If you had access to additional materials, what would you have used? Why?
- If you had to do it all over again, would your design change?

### Vocabulary

**Buoyancy:** The ability of a liquid to push up on an object immersed in it.

**Buoyant force:** The upward force exerted by a fluid on a submerged object.

**Density:** The space an object or substance takes up (its volume) in relation to the amount of matter in that object or substance (its mass). *In the submarine, the volume stays constant. The density changes by adding or taking away an object.

**Materials for submarine:**

- Water or empty soda bottle
- Soda can
- Small container with lid
- Aluminum foil
- Straw
- Tape
- Small but heavy objects (coins, washers, marbles, screws)
- Small but light objects (beads, paper clips, craft sticks, fabric pieces)
- Rubber bands
- Any other material that you find in your home.

**Materials for testing:**

- Tub or bowl ¾ full of water

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# Underwater Robot Challenge (Grades 9-12)

## Under the Sea...

How is it possible for scientist to learn so much about under the ocean? There are two main kinds of underwater robots that scientist use to gain a better understanding of the ocean floor: remotely operated vehicles (ROVs) and autonomous underwater vehicles (AOVs). Remotely operated vehicles are unoccupied, highly maneuverable underwater robots that are operated by a person on a ship or boat. Autonomous underwater vehicles are controlled by computers that are on the robot and do not require input from an operator. Not only are ROVs and AOVs important for scientific research, but they are also used by the oil and gas industry as well as for military applications and marine salvage operations of downed planes and sunken ships. ROVs come in many different sizes to address different needs, but they all contain the common elements of having a tether, frame, camera, lights, and thrusters. Sometimes ROVs even have a robotic gripper that can be used to recover objects or can be used for rescue purposes.

**Mission**: Oceaneering Robotics Design Company has hired you as an engineer to develop a prototype of a new underwater robot that will be able to collect samples and take advanced photos of the ocean floor. You will need to present the protype of the design to interested buyers that are coming from research companies and the oil industry.

**Design Process**

- **ASK**: What is the problem you need to solve? Design an underwater robot that will be able to collect samples and take advanced photos of the ocean floor.
- **IMAGINE**: Brainstorm and decide on one idea. What will your underwater robot look like?
- **PLAN**: Draw a picture of your underwater robot. Label the picture with the materials you intend to use.
- **CREATE:** Use the materials that you find in your own home to create your prototype.
- **IMPROVE:** Think of ways you could improve your invention.

### Vocabulary

**Thrusters:** Electrically or hydraulically powered propellers used to maneuver the vehicles. There are multiple thrusters used in ROVs to provide movement in multiple directions.

**Tether:** Carries electrical power and signals to the surface so that the person controlling the vehicle can see the camera.

**Frame:** Provides a structure to attach the thrusters, camera, lights, tether, and other components of the ROV.

**Requirements:**

Using recyclable and other materials you find in your own home, design a prototype of your underwater robot.

Your prototype must be waterproof. Test your prototype by placing it in a tub of water or placing it in a sink filled with water.

**Standards: C5ISR Center STEM Outreach Activities Align with the Next-Generation Science 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 the 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**: 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. 5-ESS1 Earth and Human Activity: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

**ACTIVITY THREE**: MS-ETS1-2 Engineering Design: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. MS-ESS3-3 Earth and Human Activity: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

**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.