



# Ocean Problem Solvers: Launch a Lander

## **Objectives:**

Participants will learn about the engineering design process as they hypothesize, design, and test a prototype to be used in exploring the ocean floor.

## **Background Information:**

Mote Marine Laboratory is a marine research organization based in Sarasota, Florida. Mote conducts groundbreaking research with more than 20 diverse programs focusing on today's challenges as well as identifying and addressing future impacts. The laboratory's mission is to advance marine science and education, supporting conservation and sustainable use of marine resources.

One area of research Mote is involved in is ocean technology. Technology can help tackle some of the biggest challenges the ocean faces because they can go beyond the scope of human hands, divers and observation. Some examples include remotely operated vehicles (ROVs), drones, detectors, buoys, trackers, autonomously operated vehicles (AUVs) etc.

Some of the technology deployed has helped describe the physical conditions after the Deepwater Horizon oil spill in 2010, detect harmful algal blooms at depth have been used to examine the chemistry and nutrient cycling between estuaries and the deep ocean.

## **Materials:**

- Paper and pencil to sketch design
- Small canister (film canister, candy tube or chapstick tube) to be the sampler of your lander
- Miscellaneous items to represent sampling devices on your lander (Paper clip, rubber bands, beads, string, toothpicks, pipe cleaners etc)
- Sand or rocks or coins to weigh down canister (if needed)
- Clear container of water to test your lander (a small aquarium, large tupperware, large bowl etc)
- Towel to protect your work surface

## **Introduction:**

Mote scientists and the ocean need your help. Overfishing, pollution, coastal habitat loss, coral reef degradation, sea level rise, etc. are all major issues that need to be addressed. In addition to marine biologists who study the living things in our oceans, Mote has marine engineers who design and create technologically advanced solutions to help tackle and learn more about the threats facing our marine environments.

Fishermen and recreational divers have discovered several very deep openings in the sea floor off the west coast of Florida. These are known as **blue holes**. Learn more about blue holes with [this](#) video.

We know that many species of ocean animals pass through or spend their entire lives in these diverse habitats, but that is all we know. Scientists at Mote are also interested in studying the chemistry of these areas. They want to learn more about how these areas affect other parts of the ocean, or their interrelationships.



There's just one problem, it is too dangerous for divers to go down and spend any time in these holes, which start at depths below 130 feet, with some reaching depths of 350 feet.

Your mission: Mote needs your help to design an instrument to send down to collect sediment, core samples and water samples at a depth of 350 feet.

Watch this [video](#)

### **Procedure:**

Follow the steps of the engineering design process to create a prototype for a device to send down into a blue hole.

### **Brainstorm**

How will you design your lander?  
What size, shape and weight should it be?

### **Plan**

How will the lander be deployed/retrieved?  
How will you guide the lander down, over and into the hole?

### **Design**

Draw a design of your prototype.

### **Build**

Use your gathered supplies to build your prototype.

### **Test**

Test your prototype to see if it works according to the design requirements. Your lander should:

- be carefully deployed to the bottom
- be negatively buoyancy (sinks slowly to bottom)
- rest on the bottom in an upright position
- be retrieved and returned to the surface

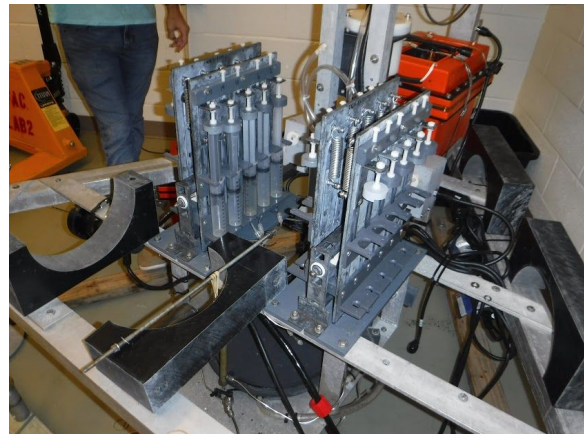
### **Evaluate and Share**

Evaluate the pros and cons of your design. What worked? What could be improved upon? What challenges did you face? Share your results with someone.

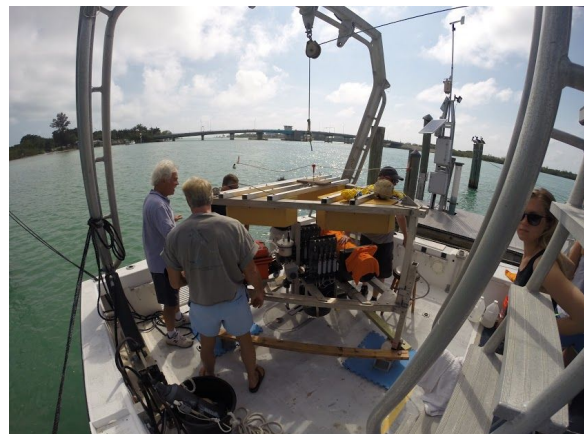
### **Wrap-Up:**

Check out [this](#) video and the photos below to see the lander design and deployment process Mote scientists used to study a blue hole.

Lander being constructed in lab:



Lander on boat:





**Extensions:**

Continue the engineering design process by implementing the changes you brainstormed in the evaluation step. Was it more successful?

Do you think there would be a difference in performance if you placed your lander in saltwater? Test it out! Dissolve some salt in your container and retest.

AUVs and ROVs generally need to be neutrally buoyant (hang suspended in the middle of the water). Can you create a prototype that does that?

Watch [this](#) PBS produced video featuring Mote scientists studying a blue hole.