# Search and Rescue Mission

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<th>Middle School</th>
<th>Standard(s): MS-PS2-2; MS-ETS1-1 through MS-ETS1-4; CCSS.SL.1, CCSS.SL.4</th>
<th>Topic: Designing a search and rescue mission</th>
<th>Developed by: ASNE</th>
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**Overview:** Students will design a solution to an engineering problem in groups and share those results. Then, students will interact with the same engineering problem through FLEET.

**Sample Lesson Flow**

- **Day 1:**
  - Design a solution to an engineering problem (15 min), share results (10 min), attempt FLEET search and rescue mission (15 min), closing discussion about using data in FLEET (5 min)
  - Design a solution to an engineering problem (25 min), share results (15 min), attempt FLEET search and rescue mission (45 min), closing discussion about using data in FLEET (5 min)

**Prior Student Knowledge Required:**

- Engineering Design Process

**Student Learning Objective:**

- Design a ship that will be able to rescue shipwrecked sailors.

**Materials:**

- Computers set up with FLEET (Optional, Step #1)
  - Technology to play YouTube video

**LESSON PLAN – (This uses the 5-E Model)**

**Engage**

1. Start with students in groups and remind them of your engineering design process. Today’s engineering process is:
   
   Design a ship that can quickly save shipwrecked sailors that are miles away from harbor. You will pitch your design to the Coast Guard in a one-minute presentation.

   a. Tell students that they will pitch their ideas to the Coast Guard in a one-minute presentation. The Coast Guard will want to know what variables students considered and how students plan to test their design.

   b. **(Optional)** If you already have many students that have engaged with the Search and Rescue mission, you may want to tweak the initial engineering task by asking the groups to design a system that will allow the Coast Guard to know when a ship is wrecked within America’s territorial waters (12 nautical miles from shore).

   c. **(Optional)** You could also use this NOAA video in your wrap up discussion:

   ![YouTube Video](https://www.youtube.com/watch?v=xNQt4QlvV64)

2. Previous design challenges involved using water. This challenge involves considering all the problems caused by a Search & Rescue mission and adding or honing to the theoretical design students make. Even though their design is theoretical, encourage students to describe how to test their design.

**Explore**

3. Students should be able to work on these problems with minimal educator input. If you would like to guide the discussions, you could ask questions like:

   a. What data will you collect to evaluate your design?

   b. Are you thinking about forces and acceleration in your designs? How will you use this knowledge to improve your design?

   c. I like your design. What can you do to make it even better?

   d. What would you do to test your design?
Explain & Elaborate

4. Have students share their process and ask each group a follow-up question about how they addressed a step in your design process.

5. **(Optional)** If you want to choose a winner, score the teams’ presentations on how the presentations reflected each step of your engineering process.

Explore

6. Hopefully a group suggested testing using a simulator as well as in real-life. Simulators are a common way engineering groups of all types save resources while testing their designs. Now your engineers will test and re-test designs in the simulator, FLEET.

7. **FLEET Challenge: Today’s challenge is to complete the Search & Rescue mission with the highest score.**

   - Have students log into FLEET and create a ship for the Search and Rescue mission. Students can read the mission description by clicking the book in the upper right corner and then selecting the “Missions & Achievements” tab. We included that text here so you can have it handy as you walk around. In particular, ask students what the objectives are (these are the engineering design goals, so students must keep them in mind).
   - **FLEET Text:** Design and build a stable ship that can rescue a group of shipwrecked mariners. Make sure you stay under budget, stay close to design displacement, and have all the necessary equipment. Remember, you need to get the men out of the water as quickly as possible. Salvaging their sinking ship is a bonus.
   - **Objectives**
     - Find the fishing boat.
     - Recover the mariners.

8. Be sure to show students how the color changes as they address each design requirement.

9. These missions could take a very long time (20+ minutes). That’s ok. Students are exploring what works and what doesn’t work and using that information for the next test. Once a student has gathered data on their design solution, they may choose to restart the mission without completing it.

10. After each group completes the mission, ask them to consider how the score is calculated.

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What does the score show you is important in successful search and rescue missions? How can you use this feedback to improve your design?
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   - **NOTE:** If students need an additional challenge, show them how to change the Environment from “Sunny” to “Storm” when they choose the mission. (After they hit the green play button in the drydock and the missions and tests appear, there is a drop-down menu for “Environment” in the lower left.)

11. Save 5 minutes for a wrap-up discussion by asking students:

   - **How did you collect and use data? How did you use the engineering design process?**
   - **What was your best solution so far?**

The next class will be the final class and the first half of class will be spent improving and perfecting this design.

Additional Resources

A. The United States National Search and Rescue Supplement (link below) has 243 pages describing Search and Rescue missions. The glossary of terms on page xiii is particularly good:

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B. If you have the ability to play a video on mute while students are working in FLEET, we suggest this
GoPro video of a U.S. Coast Guard rescue swimmer. Probably worth muting the clip since the only real noise is the helicopter. https://www.youtube.com/watch?v=IPERJ-p4qU

C. Search and Rescue as a job is shown by this report by ABC in Virginia Beach. You can make connections between the practice of these professionals with the testing done by engineers because both give feedback and experience used to create a great final product. https://www.youtube.com/watch?v=Io_c_GxiwAM