



U.S. Department of Commerce  
National Oceanic & Atmospheric Administration  
National Marine Fisheries Service

# Lesson 12: Technology

## Overview

Lesson 12 presents some common technologies that are used to monitor the ocean. In the activity, students examine temperature and density data to detect the presence of hydrothermal vents in the ocean.

## Lesson Objectives

Students will:

1. Identify the function of common ocean technologies used to take in situ<sup>1</sup> measurements
2. Explain how data from CTD (Conductivity, Temperature and Depth) devices are used to locate hydrothermal vents
3. Interpret CTD data to predict the location of a hydrothermal vent

## Lesson Contents

1. Teaching Lesson 12
  - a. Introduction
  - b. Lecture Notes
  - c. Additional Resources
  - d. Student activity
2. Student Handout
3. Mock Bowl Quiz

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<sup>1</sup> In the actual ocean environment

## **Standards Addressed**

### ***National Science Education Standards, Grades 9-12***

*Science and technology  
Science in personal and social perspectives*

### ***Ocean Literacy Principles***

*The ocean is largely unexplored*

### ***DCPS, High School Environmental Science***

*E.1.10. Select and use appropriate tools and technology to perform tests, collect data, analyze relationships and display data*

## Lesson Outline<sup>2</sup>

### I. Introduction

Ask your students what they think about when they hear of the National Aeronautics and Space Administration (NASA). Most of them probably think about space travel and the study of other planets. But NASA also launches equipment, sometimes in partnership with NOAA and other agencies and organizations, to help scientists study the oceans.

Ask your students to guess how many of the scheduled NASA launches in 2010 involved monitoring the Earth's oceans and climate. The answer is almost half (3/7)! You can visit the link to the launch schedule below if you want to give the students more information about future missions: <http://tinyurl.com/qha84>.

If your computer has QuickTime, you may also want to show students a video of the launch of the Jason-2 satellite – one of the technology highlights of today's lesson. Visit the link below and click on the second video down on the right-hand side of the screen:  
<http://tinyurl.com/4fe7w5j>.

### II. Lecture Notes

Use the PowerPoint for Lesson 12 (File: Technology I.ppt) to present the technology highlights.

### III. Additional Resources

1. Background Information  
<http://www.windows2universe.org/earth/Water/CTD.html>  
<http://www.whoi.edu/instruments/viewInstrument.do?id=1003>

### IV. Student activity

The activity for this lesson was provided courtesy of SEAS (Student Experiments at Sea) and is included in two separate files in the Lesson 12 folder (Files: Vent\_Activity.pdf and Vent\_Activity\_Graphs.pdf). This and other lessons from SEAS can be found at the following link: [http://www.ridge2000.org/seas/for\\_teachers/curriculum/unit1.html](http://www.ridge2000.org/seas/for_teachers/curriculum/unit1.html).

NOAA and NASA launched a Geostationary Operational Environmental Satellite (GOES) called GOES-14 on June 27, 2009. Together with other similar satellite, the GOES-14 helps scientists track weather events and solar storms.



Photo: NOAA

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<sup>2</sup> Unless otherwise indicated, all websites provided or referenced in this guide were last accessed in November 2010.

An alternative lesson using satellite imagery is also included in the Lesson 12 folder (Files: Exploring\_Sat\_Images.pdf and Sat\_Questions.pdf). This lesson requires a color printer. This lesson was created by Amy Cline for the University of New Hampshire Coastal Observing Center. It is reprinted with permission.

### Tips for the Bowl - Technology

Complete the crossword (created by R.Gasper using CrosswordPuzzleGames.com) and use it as a study guide for the Bowl.



# CROSSWORD PUZZLE GAMES

[CrosswordPuzzleGames.com](http://CrosswordPuzzleGames.com)

### Your Crossword Puzzle

					1			2		
	3									
4										
										5
	6									
						7				
			8							
9										
			10							
11										

Navigation
<a href="#">Home Page</a>
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Crossword Puzzles
<a href="#">Large Puzzles</a>
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<a href="#">Small Puzzles</a>
<a href="#">Extra Small</a>

<p><b>ACROSS</b></p> <p>4. Wayward wanderer or ocean technology?</p> <p>6. Slightly more complex than CTD</p> <p>7. They collect wave data</p> <p>9. The first satellite for ocean studies</p> <p>10. – and the <i>Chipmunks</i>, also the name of an oceanographic submersible</p> <p>11. Moving around the Earth, like a satellite</p>	<p><b>DOWN</b></p> <p>1. Satellite type that orbits yet 'stays' in place</p> <p>2. These might be found in a Naskin bottle</p> <p>3. A drifter can sense this</p> <p>5. The most recently launched low-orbit satellite</p> <p>8. Buoys can detect these dangerous waves</p>
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## **Tips for the Bowl - Technology**

### Crossword Answer Key

1. GOES
2. Plankton
3. Pressure
4. Drifter
5. Jason2
6. Sonde
7. Buoys
8. Tsunamis
9. Seasat
10. Alvin
11. Orbiting

## Technology I

1. Which of the following is *not* true of a geostationary satellite?
  - w. Its orbit is the same speed as that of Earth
  - x. It monitors the same spot on earth
  - y. It monitors ocean temperature
  - z. **It rotates around the Earth**
  
2. Reminder question: Traditionally, salinity has been expressed as...?
  - w. Grams per cubic centimeter
  - x. Parts per million
  - y. Grams
  - z. **Parts per thousand**
  
3. The first satellite dedicated for ocean studies was:
  - w. Oceansat
  - x. Mersat
  - y. **Seasat**
  - z. Aquasat
  
4. A CTD measures which of the following:
  - w. Connectivity, Temperature, Depth
  - x. **Conductivity, Temperature, Depth**
  - y. Conductivity, Temperature, Density
  - z. Currents, Temperature, Depth
  
5. How is a sonde different from CTD?
  - w. **A sonde is more complex and can measure properties a CTD cannot**
  - x. A sonde orbits Earth while a CTD is placed in the water
  - y. A sonde is stationed on-shore while a CTD is off-shore
  - z. A sonde measures physical properties of seawater while a CTD measures chemical properties
  
6. Short Answer: What piece of technology would you use to collect a water sample from 200m deep?  
**Answer: Niskin bottle**
  
7. The following piece of technology measures currents several feet under the surface of the water while attached to small floating devices:
  - w. Sonde
  - x. CTD
  - y. Niskin bottle
  - z. **Drifter**

8. Short answer: This satellite, launched in 2008, follows a low orbit and takes measurements that help scientists measure sea level rise...  
**Answer: Jason-2**
  
9. Short answer: What does POES stand for?  
**Answer: Polar Orbiting Operational Environmental Satellite or Polar Operation Environmental Satellite acceptable**
  
10. Team Challenge Question included in a separate document in the Lesson 12 folder(File: NOSB.Tech.pdf). This Team Challenge Question is from the National Ocean Sciences Bowl website, [www.nosb.org](http://www.nosb.org).