6.1 REMOTE SENSING

What is remote sensing and radar?

Activity Time: 45 minutes

Background

Remote sensing is the process of gathering information about an object without actually being in contact with it. Scientists use airplanes, satellites, weather balloons, and Uninhabited Aerial Vehicles (UAV) to gather information about Earth, other planets, and the universe. CReSIS scientists gather information about the polar regions through remote sensing. CReSIS engineers have built radars, which use electromagnetic waves, to explore glaciers and ice sheets and collect data. In this lesson, students will be able to examine the four main parts of a radar system, build their own "simplified" radar and understand how engineers and geologists collaborate to gain a better understanding of the changes happening to our polar ecosystems.

Materials

- Tennis ball
- Radar labels
- Data chart and graph paper
- Timer
- Remote Sensing Worksheet
- Lady Liberty Lab

Directions

1. Introduce students to remote sensing via "Making Sense of Remote Sensing" worksheet and powerpoint. Be sure to read the notes section in the powerpoint presentation.
2. Identify the four parts of radar (Transmitter, Receiver, Data Recorder, Data Processor).
3. Read and follow directions for Lady Liberty Lab.

IN LADY LIBERTY LAB YOU WILL:

- **Be an engineer** – build a simplified radar, collect data and process (graph) the data.
- **Be a geologist or glaciologist** – interpret the results.

Discussion

- What does the tennis ball represent?
- Why is it important to know how long it takes for the tennis ball to return to the receiver?
- Is the Statue of Liberty underneath Liberty glacier? Why or why not?
- Explain how CReSIS engineers and geologists work together to study the polar regions.

Assessment

Ask students to interpret another graph and have them justify their answer on whether or not the Statue of Liberty is buried under Liberty glacier.

Extension

Students can calculate the actual ice sheet thickness of Liberty Glacier by using the following equation. *First assume that we were timing in microseconds instead of seconds, then:*

$$\frac{\text{TIME (MICROSECONDS) / SPEED OF LIGHT (3.3 MICROSECONDS PER KM)}}{\text{INDEX OF REFRACTION IN ICE (1.77)}}$$

Vocabulary

Remote Sensing: the process of gathering information about an object without actually being in contact with it.

UAV: Uninhabited Aerial Vehicle; an uncrewed (without a pilot) aerial vehicle that can fly in dangerous situations.

ALIGNMENT TO NGSS:

Scientific and Engineering Practices
- Asking questions
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Constructing explanations
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

Crosscutting Concepts
- Cause and effect
- Systems and models
- Energy and matter