THE SCIENCE OF FRINGE

EXPLORING: REMOTE SENSING

A SCIENCE OLYMPIAD THEMED LESSON PLAN
SEASON 2 - EPISODE 23: **OVER THERE (PART 2)**

Overview:
Students will learn about how various types of sensors can be used to remotely collect information about a geographical area, which allows for unique scientific analyses and discoveries.

Grade Level: 9–12

Episode Summary:
In the alternate universe Walter, Olivia and William work together to try to find Peter and convince him to return to their universe, while Peter attempts to find out the nature of the device Walternate gave to him. In the process, both Walter and Peter are shown the extent of the devastation the Fringe events have had on the alternate universe as a result of Walter's original opening of the portal. Meanwhile, Walternate and the alternate Fringe team work to find and detain the 'intruders' using the various surveillance technologies they have available. Once they locate them, the two teams finally meet in a climatic encounter that significantly changes the nature of future interactions between the universes.

Related Science Olympiad Event:
Remote Sensing - Teams use maps and remote sensing technology to explain human impact on the Earth.

Learning Objectives:
Students will understand the following:

- Remote sensing can be more cost effective and quicker than ground-based data collection while having minimal impact on the location being observed.
- Sensors used in remote sensing rely upon the fact that all objects either emit or reflect various types of electromagnetic radiation.
- With data processing and modeling, many additional parameters and characteristics of an area can be determined beyond those that were directly measured.

Episode Scenes of Relevance:

- Peter and Walternate viewing the map of Fringe events.
- Walternate and the Fringe team searching for Olivia.
- View the above scenes: http://www.fox.com/fringe/fringe-science

Online Resources:

- Fringe "Over There (Part 2)" full episode: http://www.fox.com/watch/fringe
- Science Olympiad Remote Sensing event: http://soinc.org/remote_sensing_c
- USGS Terrestrial Remote Sensing: http://terraweb.wr.usgs.gov/
- NASA Remote Sensing tutorial: http://rst.gsfc.nasa.gov/
- IEEE Geoscience and Remote Sensing Society: http://www.grss-ieee.org/

Procedures:

1. Tell your students that they are going to learn about remote sensing and how scientists can use it as a tool to learn about a geographic area.
2. Have your students research remote sensing in resources such as physics textbooks (sections on satellites) and websites and discuss what they have learned.
3. Divide your class into groups. Have each group complete the following activity:
    a. Materials: shoe box containing small rocks and pebbles, ruler, drinking straws, push pins
    b. The shoe box should have enough rocks and pebbles in it to just cover the bottom, and create a simulated rocky landscape. The box should be taped shut so the students can't initially see into it.
    c. The group is to simulate the way a satellite collects data to create a topographical map.
    d. Mark off a grid on the top of the shoe box and use the push pin to create small holes at each grid point.
    e. Gently slide a drinking into each hole until it encounters resistance, then mark the depth of the drinking straw and remove and measure how deep it went.
    f. Record the depths at each grid point on a sheet of paper and use the results to calculate the topographic layout of the rocks and pebbles in the box.
    g. Once done, remove the shoe box lid and compare the calculated layout to the actual topography present.
4. Discuss with the class the results of the activity. Be sure to address:
    a. How smaller grid spacing resulted in a more accurate map.
    b. That the lid of the box served as a reference plane for all measurements.
    c. Multiple measurements could be made from each hole by putting the straws at various angles.
    d. How this process compares to actual satellite radar altimetry.

Additional Discussion Suggestions:

- Remote sensing systems can combine multiple types of sensors to collect related data. What other types of measurements could have been made through the holes to understand the nature of the surface in the box?
- If they had been shown just a photo of the contents of the box, why wouldn't they have been able to easily determine the topography? How could this be resolved with multiple photos taken from various angles?

Extension to Other Subjects:

History: Remote sensing is regularly used to find the ruins of ancient civilizations in remote locations like jungles and deserts. Research some examples from South America or the Middle East and discuss what discoveries were made possible only through the use of remote sensing.

Fine Arts: Many remote sensing images provide unusual perspectives and views of the world. Find some examples that are particularly artistic and discuss why they can often have a significant impact on the viewer.

Social Studies: Remote sensing is used significantly by countries to spy on one another. Discuss how having such information impacts the political landscape and diplomatic position of countries that possess the capability compared to those that do not.

National Science Standards Alignment:

C. Life Science – Life science focuses on science facts, concepts, principles, theories, and models that are important for all students to know, understand, and use.

H.C.4 Interdependence of organisms

e. Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.

U. Unifying Concepts and Processes – Unifying concepts and processes help students think about and integrate a range of basic ideas which builds an understanding of the natural world.

H.U.2 Evidence, models, and explanation

a. Evidence–Evidence consists of observations and data on which to base scientific explanations. The goal is to help students use evidence to understand interactions and predict changes.

b. Models–Models are tentative schemes or structures that correspond to real objects, events, or classes of events, and that have explanatory power. The goal is to help students learn how to make and use many models, including physical objects, plans, mental constructs, mathematical equations, and computer simulations.

c. Explanations–Explanations provide interpretation, meaning, or sense to objects, organisms, or events. Explanations incorporate existing scientific knowledge and new evidence from observations, experiments, or models into internally consistent, logical statements, such as hypotheses, laws, principles, and theories. The goal is to help students create explanations which incorporate a scientific knowledge base, logic, and higher levels of analysis.