Ada Lace and Ham Radio Exploration Chapter 3

Objectives:

Students will:

- Explore the role of ham radios in historical and modern communication.
- Investigate how repeaters function and their impact on radio transmission.
- Analyze the problem-solving techniques used by Ada Lace.
- Apply mapping skills to identify obstacles affecting radio signals.
- Engage in hands-on activities to reinforce learning through real-world applications.

Suggested Grade Levels:

3rd-8th Grade

Subject Areas:

- Science (Earth & Space, Physics, Engineering)
- Technology
- Reading and Literacy
- History

Time Allotment:

2-3 class periods (45-60 minutes each)

Next Generation Science Standards:

- **3-PS2-4:** Define a simple design problem that can be solved by applying scientific ideas about magnets and electric forces.
- **3-5-ETS1-1:** Define a simple design problem reflecting a need or a want that includes criteria for success and constraints on materials, time, or cost.
- **4-PS3-4:** Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- **5-PS1-3:** Make observations and measurements to identify materials based on their properties.
- **MS-PS4-3:** Integrate qualitative scientific and technical information to support the claim that digitized signals are a reliable way to encode and transmit information.
- **MS-ETS1-1:** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution.

Background Information:

- Ham radio, or amateur radio, allows individuals to communicate over long distances without the need for cell towers or the internet. Repeaters help amplify and extend signals, overcoming obstacles such as hills and buildings. In this chapter, Ada Lace experiments with a repeater to improve her radio transmissions and connect with people across different locations.

Vocabulary:

- **Repeater** – A device that receives a signal and retransmits it over a greater distance.
- **Call Sign** – A unique identifier assigned to a radio operator.
- **Radio Waves** – Electromagnetic waves are used to transmit information.
- **Phonetic Alphabet** – A standardized system for spelling out words over the radio.

Materials:

- Copies of Ada Lace, Take Me to Your Leader (1 per pupil or projection device)
- Ada Lace, Take Me to Your Leader Part 1 of 3 (13:10-end of day 1)
- Ham radio (if available)
- Maps (Google Earth, digital, or paper)
- Markers or pins for mapping activities (as needed)
- Access to a computer or tablet for online research
- Basic electronic circuit components Snap Circuits (optional, for advanced learners)

Lesson Procedures:

1. **Before Reading Discussion:**
    - Review Chapter 2 and discuss key takeaways.
    - Introduce the concept of radio communication and repeaters.
    - Ask students to predict what challenges Ada might face in her radio experiments.
2. **Reading Chapter 3:**
    - What is in the black briefcase? *(Repeater)*
    - Explain (or look up) the function of a repeater. *(Retransmits signal, stronger, over a broader area)*
    - Which feature(s) of the neighborhood might be the problem? *(Hills & trees)*
    - Can you elaborate on the reason that trees are a problem?
    - Predict: Which season/seasons might help minimize the issue with trees? (Winter & late fall)
    - How do they set up the repeater for Ada? *(In the tree near her window)* Is it successful? *(Yes)*
    - Find Mr. Peebles's call sign. *(KZ6D)*
    - Does the radio use magic? *(No)* What facts would you use to support this?
    - What does the technology use to transmit? *(Radio waves)*
    - Offer the clues Ada has about her new local friend without a name: (KD86E kite GoPro)
    - How does she get Nina to agree to come over again? (begging, pleading, agreeing to go to a movie)
    - Where do the missing headphones turn out to be? (brother's stuffed pig)
    - Why is Nina freaking out when Ada returns to her room? (voice came back, "Take me to your leader")
    - Why does the boy, KD86E, say he won't tell his name? (his mom says he is not supposed to)
    - What time did the boy say he was eating dinner? (9:00)
    - Do these details seem suspicious to you? Why or why not? (answers may vary)
3. **Hand-on Activities:**
    a. **Activity: Identifying Obstacles to Radio Communication**
        - Using Google Earth, digital, or paper maps of your local community, students identify obstacles (e.g., hills, buildings, forests) that might interfere with ham radio signals.
        - Discuss how these obstacles compare to those in Ada's neighborhood.
    b. **Pinning California Locations**

- Students use Google Maps to locate and pin places mentioned in the chapter:
  - Oakland *(boy building robots)*
  - Marin *(girl starting an engineering club)*
  - Alameda *(rocket scientist launching a weather balloon)*
- Discuss why radio communication is useful for connecting people in different locations.

c. Comparing Listening Experiences

- Students create a T-chart comparing Ada and Nina's experiences while listening to the same radio.
  - **Ada's Experience:** Problem-solving, learning, engaging with others.
  - **Nina's Experience:** Suspicious, unsure, hears a strange voice.

d. Researching Local Repeaters

- Students research the locations of repeaters in their area using online resources.
- If possible, invite a local ham radio club representative to speak about how repeaters enhance communication.
- Example resource: Repeater Map Example

e. Understanding Call Signs and Phonetic Alphabet

- Students look up real ham radio call signs and practice saying them using the phonetic alphabet.
- Engage students in mock two-way conversations that follow the conventions of ham radio communication. (Kilo Charlie 9 Lima Echo Hotel this is Kilo Echo 9 Charlie Oscar Delta do you copy?)

Differentiated Instruction:

a. **Visual Learners:** Use videos, circuit diagrams, and maps to visualize concepts.
b. **Auditory Learners:** Listen to recorded ham radio transmissions and practice the phonetic alphabet.
c. **Kinesthetic Learners:** Engage in hands-on circuit building and Morse code challenges.
d. **ESL Students:** Provide vocabulary lists with translations and visual aids.
e. **At-risk Students:** Assign peer partners and structured guidance for activities.
f. **Advanced Learners:** Research and present on historical events where ham radio played a crucial role.

Extensions:

- Invite a local ham radio operator to discuss signal interference and problem-solving techniques.
- Research historical events where ham radio was used for emergency communication.
- Track the International Space Station and discuss how astronauts use ham radio to communicate with Earth.