

## 18. Weather Radar

**OBJECTIVES:** After completing this lesson, a student should be able to:

- \* Define an echo
- \* Identify the COLORS on the radar
- \* Investigate DOPPLER radar (Grades 4-8)

### **TEACHER BACKGROUND:** (Grades 1-8)

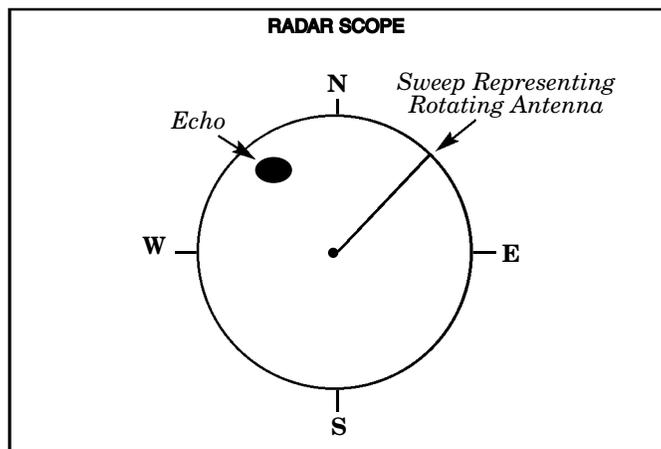
Ask students if they have experienced hearing an echo of their own voice. Under certain conditions, our transmitted voice hits an object which reflects the sound back to us. Objects which reflect our voice include the walls of the school gymnasium.

**An ECHO results when a transmitted sound or signal bounces off of an object and returns to the original transmitter.** This concept is very important in the detection of rain and snow with a special tool called *radar*. **RADAR is a radio transmitter that sends out a signal which bounces off of rain and snow.** (Weather radar does **not** detect clouds.) RADAR stands for RAdio Detection And Ranging.

### **Additional notes for grades 4-8:**

The radar signal is transmitted by a rotating dish antenna mounted on a tower. As the dish rotates in all directions, it sends signals that quickly bounce off of precipitation within a cloud. (At close range, there is some reflection of nearby objects which show up on the center of the screen, called *ground clutter*.) It doesn't take long for an echo to return to the radar dish. If the radar receives a precipitation echo, it places the echo on the radar screen (or scope). By calculating how long it took the precipitation echo to return, the radar tells the meteorologist how far the precipitation is from the station. The meteorologist can track the storm on the radar scope to determine how a storm is moving.

The line "sweeping" around the radar screen represents the radar antenna rotating in all directions. Some scopes can show precipitation in color.



The heavier the precipitation, the stronger the echo. Weather radar can detect six different intensities of precipitation, assigning a color to each. Although the colors can vary from station to station, the lightest precipitation is usually blue and green, with the heaviest precipitation yellow and red. These colors tell a meteorologist how much rain could fall on an area in one hour.

The newest type of weather radar is called *Doppler*. **DOPPLER RADAR detects precipitation and wind circulation within a cloud.** By seeing the wind pattern within a storm, meteorologists may be able to tell if a tornado is developing. Doppler radar calculates wind by detecting particles *moving either toward or away* from the radar. How can it tell how a particle is moving? By the change in the radar signal. The echo from a particle moving *away* from the radar is different than an echo from a particle moving *toward* the radar. The radar determines this and can indicate how the particle moves in the cloud.

# Weather Radar

## GRADES 1-3

### INTRODUCTORY: *BEAM BALL*

To illustrate a radar beam, tell the students that you are a radar, a tennis ball in your hand is a radar beam, and the wall is a storm cloud filled with rain. What will happen when you send the beam to the storm cloud? (The beam bounces back to you, just like radar.) Remember, only rain and snow bounce weather radar beams!

### ADVANCED: *TICKET RADAR*

Invite a police officer to class, telling them in advance that you are studying RADAR. (Some local baseball teams may also use radar to check the speed of the ball!) Students can ask how the radar is used and how quickly radar can tell the speed of a vehicle (or ball). Compare with weather radar. (Same principles, just a different target!)

## GRADES 4-8

### INTRODUCTORY: *ECHO DEMO*

Tape a mirror to a wall or chalk board. Stand a student several feet from the mirror with a flashlight. Tell the student they are a rotating radar antenna, the flashlight is sending out a radar beam and the mirror represents a raindrop in a cloud. (As they slowly rotate, make sure they reflect the beam off of the mirror.) The class should see the "echo."

### ADVANCED: *DOPPLER EFFECT*

Use a volley ball and a battery-operated toy, a "buzzing" bicycle horn or tone generator which emits a constant sound. (See your toy or electronic store.) Cut a hole in the ball and insert the toy or horn. Demonstrate that it produces a constant sound. As students toss the ball across the room, how does the pitch change? (pitch changes as ball approaches or leaves.) Why? (change in frequency)

## MAKE A RADAR SCOPE (Time: 15-20 minutes) GRADES 1-8

**Materials:** Radar worksheet #4 in appendix, scissors, file folder, round 18 oz. (510 gm) Quaker Oats® container (diameter = 4" or 10.1 cm), colored pencils

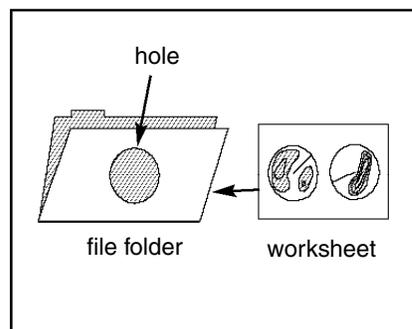
**Preparation:** Distribute a worksheet and a file folder to each student.

**Procedure:** Mark file folder 5 cm (2") from the bottom, center. Position lower edge of oats container on mark and outline edge of container on folder. Cut front of folder along line. (scope window) Color echoes on worksheet and slide sheet into the file scope.

**Evaluation:** Grades 4-8 students can compare the pictures. Which has: 1. more precipitation? 2. heavier precipitation? How are the echoes moving? How do they change?

**Excursions:** Design your own radar pictures. Also, adapt the scope to an overhead projector by cutting a matching hole on back of the folder and making a transparency of the worksheet. Push sheet through folder window as it lays on the projector.

**Computer:** Grades 4-8 students should compare and describe radar pictures.



Insert worksheet #4 into file folder radar scope

### **WEATHERSCHOOL QUESTION:**

**Obtain the question and correct answer from your local Weatherschool TV channel!**