Introduction to WSPR

Unit Overview	The purpose of this lesson is to provide the information necessary to understand the WSPR project. *Note: this is designed to provide just the basic information. Go into greater detail and take as long as is required to meet your needs.
Unit Objectives	Students will be able to understand: • radio waves • the difference between audible and inaudible signals • the effect of power levels used to generate signals and the distance that they can travel • atmospheric effects (including sunspots) on radio waves • understand the difference between amateur radio (HAM) and commercial radio • the basic purpose of the WSPR project
National Content Standards Addressed (From the National Academy of Sciences)	Content Standard A: Science as Inquiry • Use technology and mathematics to improve investigations and communications. • Formulate and revise scientific explanations and models using logic and evidence. • Recognize and analyze alternative explanations and models. Content Standard B: Physical Science-Interactions of Energy and Matter • Waves, including sound and seismic waves, waves on water, and light waves, have energy and can transfer energy when they interact with matter. • Electromagnetic waves result when a charged object is accelerated or decelerated. Electromagnetic waves include radio waves (the longest wavelength), microwaves, infrared radiation (radiant heat), visible light, ultraviolet radiation, x-rays, and gamma rays. The energy of electromagnetic waves is carried in packets whose magnitude is inversely proportional to

	the wavelength. Content Standard E: Science and Technology • Creativity, imagination, and a good knowledge base are all required in the work of science and engineering.
Suggested Grade Level(s)	High School or Middle School depending on the level of detail and complexity presented.
Suggested Time Frame	1-2 class sessions
Prerequisite Skills and Knowledge	Basic understanding of world geography, the atmosphere, power (electricity), and radios.
Materials and Equipment	To make the discussion more engaging, the use of some of the resources below, including WSPRnet.org that can be demonstrated or shown on a computer is recommended. To facilitate a whole class presentation, then some means of projection of the computer screen would be a plus. Otherwise, the use of handouts can help students to visualize the information being presented.
Introduction	• Tell students that they will be starting a project that has to do with radio waves, antenna and the World Wide Web that is called WSPRnet.org.
Providing the Basic Information	• Begin with a discussion of radio waves and how they are transmitted through space. (Here you can use the animation of radio waves listed in teacher resources below and add as much depth of knowledge as is appropriate for the grade level.) • Discuss how radio waves have different frequencies and how different frequency bandwidths are used for different purposes. Use the example of commercial radio that they are familiar with in their home and auto radios and how police and fire departments use different bandwidths to transmit their signals. • Discuss the differences between transmission and

	reception of radio signals and the basic components of each. • Discuss how the power used affects the distance that a radio signal can travel. • Discuss how atmospheric conditions, including sunspots, affect radio waves • Discuss amateur radio (HAM radio) and its function both as a hobby and as an important resource during emergency situations. • Discuss the "call signs" that are used to identify each individual HAM radio operator. • Discuss the reasons that time of day and atmospheric conditions can affect where HAM radio operators can communicate. • Discuss how the WSPR project has assisted HAM radio operators to quickly and efficiently find open pathways so that they can communicate around the world. • Look at the WSPR website and see which pathways are open based upon those transmitting and receiving WSPR signals at that time.
Conclusion	• Review radio waves and frequency bandwidths. • Review the purposes of different bandwidths. • Review how power used to generate radio waves affects how far a signal can travel. • Review the difference between transmission and reception of radio signals and the basic components of each. • Review the ways that atmospheric conditions can affect radio waves. • Review amateur radio and the ways that HAM radio operators can assist with communications during emergencies. • Review the reasons for the development of the WSPR project. • Review the locations of the open pathways that you observed.

Possible Homework	• Have students go to the WSPR map and list the countries that have pathways open at the time of their observation.
Teacher Resources	**Radio Waves** http://missionscience.nasa.gov/ems/05_radiowaves.html http://science.hq.nasa.gov/kids/imagers/ems/radio.html http://en.wikipedia.org/wiki/Radio_waves http://www.nrao.edu/index.php/learn/radioastronomy/radiowaves https://www.google.com/search?q=radio+waves&hl=en&prmd=imvns&tbm=isch&tbo=u&source=univ&sa=X&ei=D1g0T5mqDu6FsAKCmK2uAg&sqi=2&ved=0CFkQsAQ&biw=1154&bih=895 http://www.youtube.com/watch?v=al7sFP4C2TY http://phet.colorado.edu/en/simulation/radio-waves **HAM Radio** http://www.qsl.net/vu2msy/MORE2.htm **HAM Radio and WSPR** Basic Information.doc