- ***Waves and Morse Code***

- *Wireless Communication*

- Subject Area (Unit): ***Engineering***

- Concept: Wireless Communication

- Objectives This is the most adaptable of the 4 parts of the wireless communication lesson plan and affords the presenter various opportunities to explore several more complex ideas in detail. The lesson begins with a set of brainteasers (sheet attached) that present a reminder about how patterns and symbols are used. The students are then given a sound generator that they can use to create Morse code signals. The history of Morse Code and what it was used for can be presented, along with a sheet providing the key to the code. From their they are asked to complete a MadLibs exercise using Morse Code by sending words to their other group members to complete the paragraph.

  The communicators were also designed to provide opportunities to discuss the concepts of waves, including wave mixing, multi-channel communication and other concepts concerning waves as discussion in the procedure section.

     Students will be able to….
     -Recognize Morse Code and understand it as a basic communication language
     -Be able to translate into and from Morse Code for sending information using sound transmitters
     -Being to understand the role of waves in communication and some of the basics of their behavior
     -Being to explain the basics of concepts key to wireless communication such as interference, mixing and multi-channel communication

- PA Academic Standards: *3.1.7ABCE, 3.2.7ABCD, 3.4.7AC, 3.6.7BC*

- Grade Level: *6*

- Setting/Group Size: Classroom split into small groups or working as individuals.

- Duration/Time Required: *2 60 minute sessions*

Materials List: Brain Teasers Warmup Sheet, MadLibs Sheets, Morse Code Translation Sheet, Sound Generating Board (Schematic Attached)

Context: This module attempts to introduce several complex issues concerning communication and waves including wave mixing, harmonics, multi-channel communication, interference and other higher level issues using Morse Code as a basis. The transmitters for the exercise were built using several 555 timers and Op-Amps for mixing (basic schematic attached to document). These transmitters were constructed with several additional functionalities that allow demonstration of the higher-level concepts mentioned earlier.

- **Methods and Procedure:**

Begin with a basic introduction to Morse Code and why it is important in engineering and communications history. What is it? Where did it come from? How is it used or how has it been used?

After this initial discussion, provide the students with a copy of the Morse Code Translation sheet and ask them to translate a simple sentence into Morse Code in their science notebooks.

Once they have a basic grasp of how the information is translated, demonstrate communication with the sound generators by tapping out the sentence they translated in their notebooks.

Provide them with the two MadLibs sheets and ask them to complete the MabLibs without speaking, by only using the communicators. This might require some additional instruction depending on the number of groups.

Once they complete the MadLibs, ask them to read them aloud to the group.

The second stage of the lesson uses the additional functionality of the devices to demonstrate communications issues. While generating a sound with the board, adjust the trimpot on one of the 555 timers to change the frequency of the output sound. Turn on the second channel and set it to a different frequency. Now ask them if they could use the board to send signals a different way, by differentiating the two frequencies as dot and dash. Additional, ask two different groups to try to transmit Morse Code simultaneously using different frequencies, is it possible? Discuss why this might be possible. Use this opportunity to discuss the nature of sound waves. What does a wave look like? Where have they seen waves before? What creates sound waves? A good
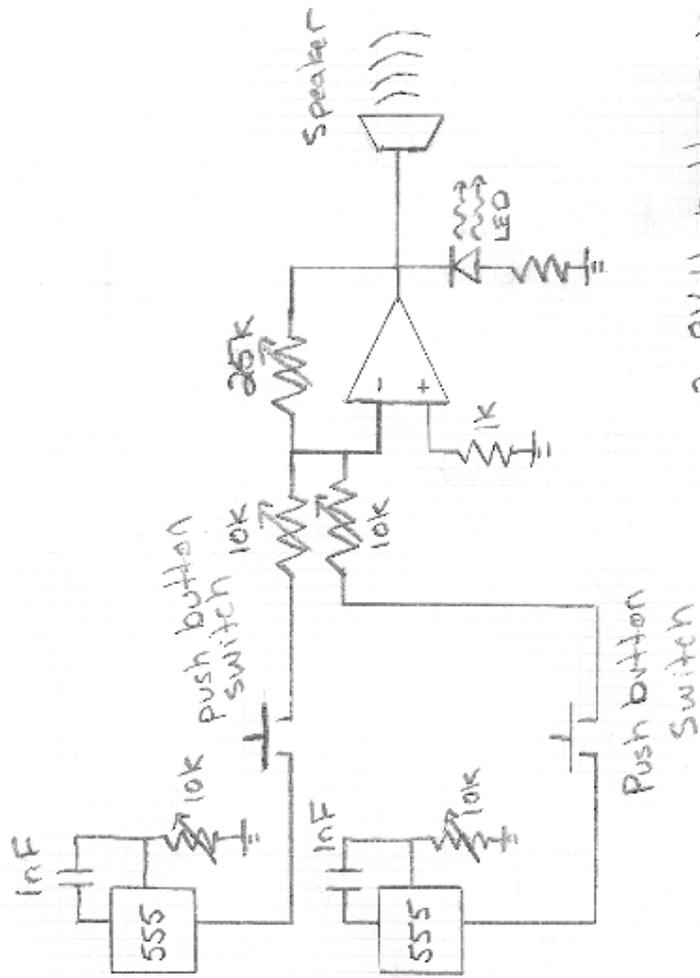
demonstration is to set the output frequency low enough that the speakers can be seen vibrating. Explain that this vibration creates pressure waves that move through the air to our ears.

Now create sound at two different frequencies on the same board. Using the two frequencies we can create a third by combining them. A demonstration of this on paper is effective, so they can see graphically how the waves might interact.

Finally, a good exercise to have them attempt to send signals in a noisy room (The hallway between classes or as other classes go to lunch works well). What difficulties does this present the receiver, are they able to accurately translate a message? Are there any mistakes? Why is it difficult to hear the signal over all the noise when I was able to distinguish it when there were only two frequencies?

This lesson requires the instructor to possess a reasonable background in waves and electronics. The discussion can be lead in any direction that the students or instructor would like and provides a good basis for the introduction of many higher-level communications concepts. Attempt to discuss what was learned from the lesson after completion and how might it apply to wireless communication that does not use sound?

- Assessment: *Project Discussion, Science Journal Entry*

- Keywords: Waves, Morse Code

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Speaker

LED

2 9Volt Batteries in Series as Power supply

35k

1k

Push button Switch 10k

10k

10k Push button Switch

1nF

10k

1nF

10k

555

555

Push button Switch

Action, Past-Tensed Verb _____

Thing, Noun _____

Action, past-tensed verb _____

Body Part _____

Action, Past-Tensed Verb_____

Thing, Noun _____

Things, Noun Plural _____

Thing, Noun _____

Food, Plural _____

Action, Past-Tensed Verb _____

Thing, Noun _____

Action, Past-Tensed Verb _____

Adjective _____

Action, Past-Tensed Verb _____

Thing, Noun _____

It Was and Exciting Day at the Zoo!

It was an exciting day at the zoo. One of the monkeys got loose from his cage. The zookeeper

chased him everywhere. First he _____ high into the _____ and

_____ by his _____, laughing at everyone below. Then he

_____ onto a _____ and jumped up and down while throwing

_____ at passersby. Below him, the _____ kept calling his name

and offering him _____ to eat. The little monkey _____ from the

_____ to the top of an ice cream vendors's cart. The monkey reached down under

the cart and _____ a/an _____ banana popsicle. The monkey

_____ into the zookeeper's arms and was carried to his _____.

Name _____

Color _____

Color _____

Shape, Plural _____

Number _____

Body Part _____

Body Part _____

Name of Song _____

Food _____

Action, Verb _____

Body Part _____

My Funny Bunny

I have a pet bunny rabbit named _____. He is _____ and _____ and has spots shaped like _____. My bunny is _____ years old and has learned many tricks. He can wiggle his _____ and hop on one _____ while dancing to "_____". His favorite thing to eat is _____. My bunny likes to leave his cage and _____ through the grassy field. One time I took him to school, and he hopped onto the teacher's _____. The entire class laughed at my funny bunny.

Some Code Brain Teasers as a Warmup:

If "Be Prepared" is "eb derapep",
what is "nac uoy evlos na ysae edoc?"

If "Scientists make new discoveries" is "snceiwednitsicsotvsemraikees"
What is " ernigeisnienetrostteucrhnndoilsogcioevse" ?

Here's an interesting way to create a code called "pigpen":
First write out the whole alphabet in two grids:
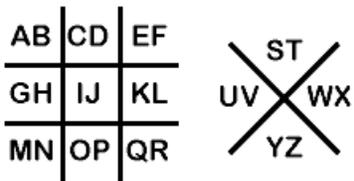
Each letter is presented by the "pigpen" that surrounds it. If it is the second letter in the box, then it has a dot in the middle.
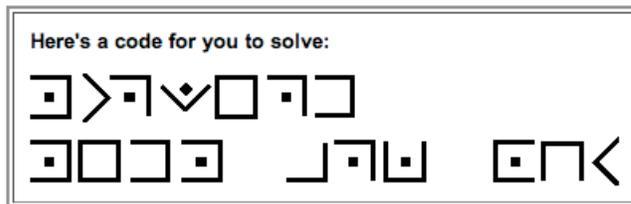
So an "A" looks like this: ⌐

A "B" looks like this : ⦁⌐

An example:

This is decoded as "Listen to the wind"

Here's a code for you to solve:

And finally a challenge: Can you figure out the pattern to decipher this code?

Smd ziv bmf gmwzb?