# Morse Telephone

## Grades 3-5

## Teacher Guide
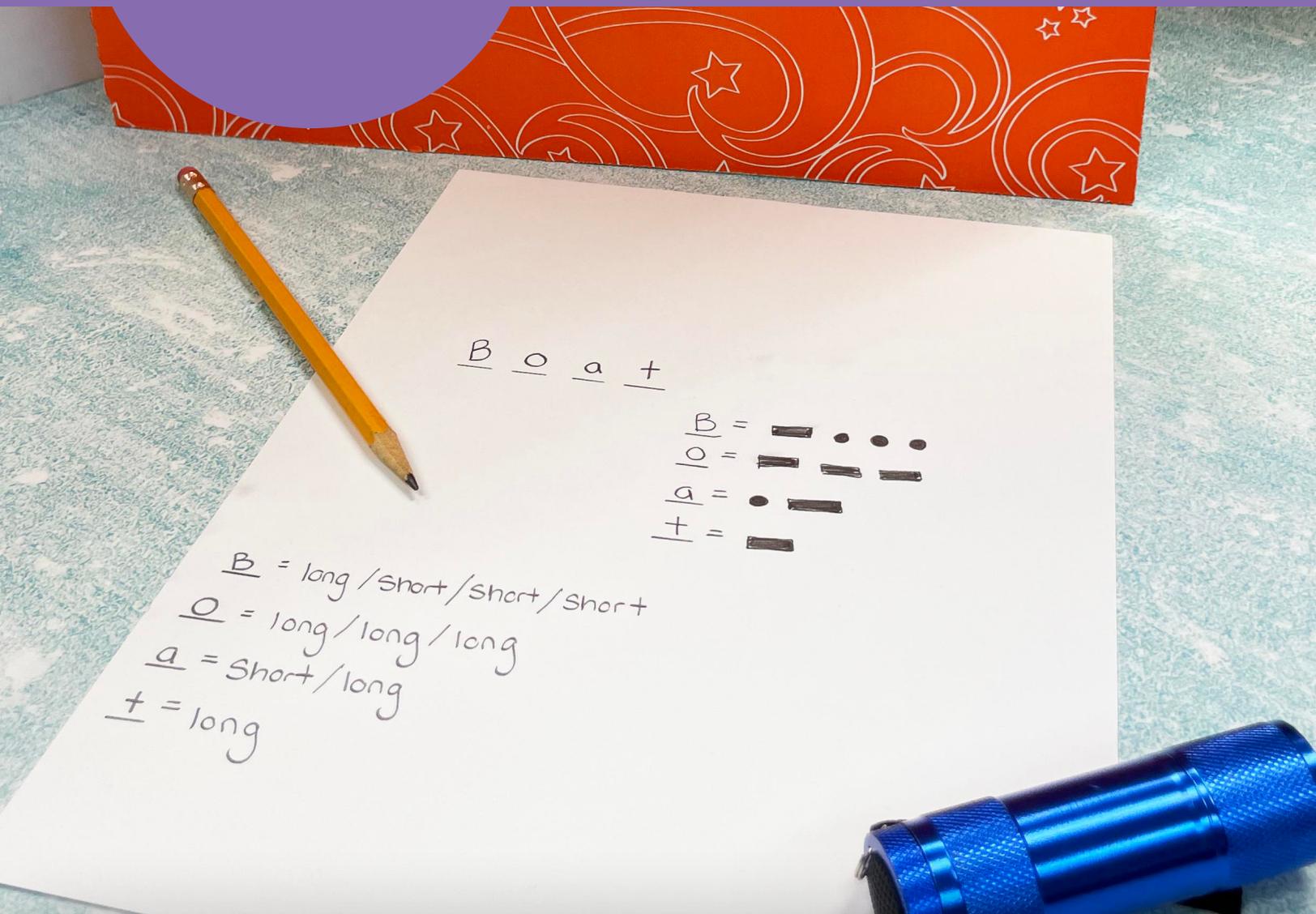
# Morse Telephone

## Seaworthy STEM™ in a Box Educator Kit description:

**Seaworthy STEM™ in a Box** activities are a Navy initiative to provide enhanced Naval-relevant, standards aligned, hands-on activities to K-12 teachers and students. Components of this program include, curated sets of classroom activities that aim to build deep conceptual understanding in Naval-relevant content areas. The kits also includes comprehensive lesson plans, material lists, scientific background information, STEM related literacy books, and student activity sheets. The **Seaworthy STEM™ in a Box** program is designed to support teachers as they select content, acquire materials, and implement more hands-on STEM activities in their classrooms. Increasing student access to hands-on STEM activities, also increases awareness of STEM career paths, engage students in STEM, and support development of student's abilities in STEM content.

The **Seaworthy STEM™ in a Box** kits were designed to guide students through the scientific inquiry-based theory and the engineering design process. The content and Naval-relevant activities are aligned with the Next Generation Science Standards. The topics and content covered within the lessons are connected and scaffolded based on distinct grade bands (K-2nd, 3rd-5th, 6th-8th, and 9th-12th).

**NAVSEA**

SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS

# Table of Contents

# Lesson Title: Morse Telephone

**Time:**
1 Class period (45-60 minutes)

## Student Objectives:

Students will learn how Morse code is a type of coding used for a line of communication. Students will work in teams to communicate in Morse code. Students will have to work together to receive the correct message.

## Lesson Overview:

Students will learn how light and sound travels in waves. Students will also learn about Morse code which was one of the first forms of naval communication. Students will be placed in teams to play the traditional game of telephone with a twist. Each student will have a job to complete the line of communication in the telephone activity. Students will have to use Morse code to communicate from partner to partner. The goal is to repeat the exact same code/message from the original messenger.
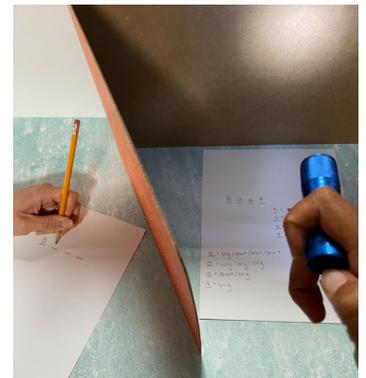
## Next Gen Science Standards:

4-PS4-3
4-PS4-2
3-PS2-3

A cross-disciplinary approach can accommodate diverse learning styles!

## Materials and Equipment List (Per Team):

- ☑ Pencil
- ☑ Paper
- ☑ Flashlight
- ☑ Morse Code worksheet
- ☑ Desk dividers or a way to cover Code creators' work
- ☑ Calculator

## Student Activity Sheets/Handouts:

Morse Code Student Activity Workbook
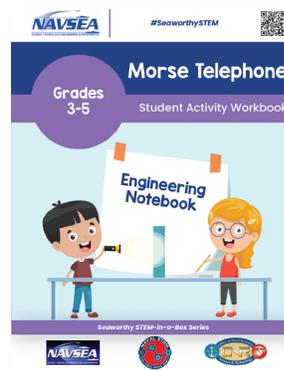
## Technology Tools:

A calculator

## Suggested STEM Related Literacy Book:

*Samuel Morse, That's Who!* by Tracy Nelson Maurer
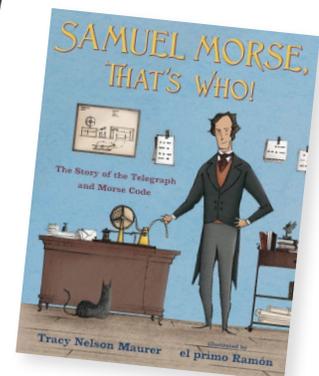
## Procedure:

**1** Students will receive a brief introduction to sound and light waves. Students will also gain knowledge about Morse code. The teacher will explain how Morse code has been a way for ships to communicate while at sea.

**2** The teacher will split up the class into teams of four and give a job title to each student.

**3** Each member of the team will receive an individual job and a Morse code worksheet that is in the student Engineering Notebook. The following jobs are listed below in order:

- A. **Code creator** – In charge of creating the secret word and transferring it into written Morse code.
- B. **Coder of light** – In charge of decoding the Morse code and transferring it to light code.
- C. **Coder of sound** - In charge of decoding the light code and transferring it to sound code.
- D. **Code writer** - In charge of decoding the sound code and transferring it to the original Morse code.

**4** The teacher will explain and model the activity. The teacher will go over the directions on page 9, under 'Student Direction' tab.

**5** When the activity is completed, the teacher can guide students into a whole group discussion with the following conclusion guided questions.

1. "Did your group relay the secret word correctly?"
2. "What was challenging about this activity?"
3. "What kind of job would be in charge of line of communication on a boat?"
4. "What kind of duties would this job be in charge of?"

The teacher can guide students through the following questions:

"How do you think ships are able to communicate over seas?"

"What is coding?"

"Is speaking the only way we communicate to each other?"

Helpful tip: Prior to students starting, go over rules of the game and go over how students will represent the difference between short and long dashes of code to represent Morse code. On page 8, is an example of how students will use the Morse code chart in their student engineering notebook.

## Morse Code Chart:

| | | | | |
|---|---|---|---|---|
| A | ● ▬ | | T | ▬ |
| B | ▬ ● ● ● | | U | ● ● ▬ |
| C | ▬ ● ▬ ● | | V | ● ● ● ▬ |
| D | ▬ ● ● | | W | ● ▬ ▬ |
| E | ● | | X | ▬ ● ● ▬ |
| F | ● ● ▬ ● | | Y | ▬ ● ▬ ▬ |
| G | ▬ ▬ ● | | Z | ▬ ▬ ● ● |
| H | ● ● ● ● | | | |
| I | ● ● | | 1 | ● ▬ ▬ ▬ ▬ |
| J | ● ▬ ▬ ▬ | | 2 | ● ● ▬ ▬ ▬ |
| K | ▬ ● ▬ | | 3 | ● ● ● ▬ ▬ |
| L | ● ▬ ● ● | | 4 | ● ● ● ● ▬ |
| M | ▬ ▬ | | 5 | ● ● ● ● ● |
| N | ▬ ● | | 6 | ▬ ● ● ● ● |
| O | ▬ ▬ ▬ | | 7 | ▬ ▬ ● ● ● |
| P | ● ▬ ▬ ● | | 8 | ▬ ▬ ▬ ● ● |
| R | ● ▬ ● | | 9 | ▬ ▬ ▬ ▬ ● |
| S | ● ● ● | | 0 | ▬ ▬ ▬ ▬ ▬ |

1.) Let's practice some coding!
In the box below, think of a 4-5 letter word. Write down the word below in blank letter slots. Then transfer that word into Morse code using the chart above.

B o a t s

B = ▬ ● ● ●
O = ▬ ▬ ▬
A = ● ▬
T = ▬
S = ● ● ●

Check out these great examples of a student's observation!

Now with your secret word from question # 1, test your ability to decode by transferring your word into sound and light code. Use the key below to guide you.

B o a t s

Light :
B = long/short/short/short
O = long/long/long
A = short/long
T = long
S = short/short/short

Sound :
B = knock/clap/clap/clap
O = clap/clap/clap
A = knock/clap
T = clap
S = knock/knock/knock

# Student Directions:

**1** The Code creator will start first by creating 1 word (4-5 letters long) to communicate with the rest of the team. The Code creator will write down each letter and then translate it into Morse code on a piece of paper, then the code creator will give the Morse coded word to the coder of light.



**2** Then the Coder of light will use the flashlight to transfer the written word into Morse code by using flashes of light directed towards the Coder of sound.
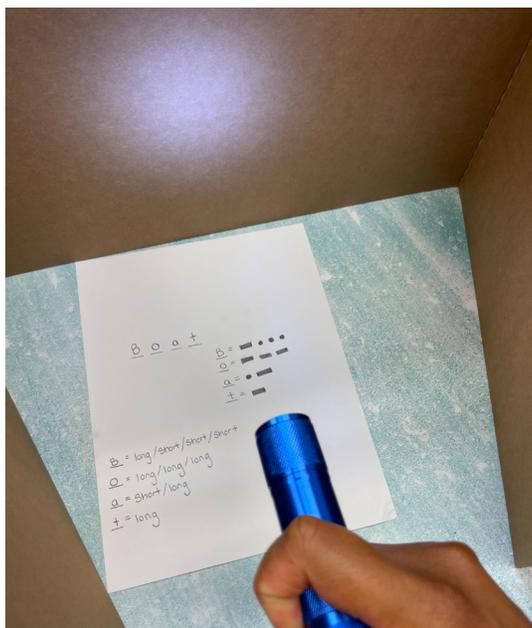
**3** Then the Coder of sound will interpret the flashes of light into sound. The Coder of sound will use Morse code by knocking and clapping the given code. The Coder of sound will direct it towards the Code writer.

**4** Finally, the Code writer will interpret the sounds into the original form, a written word/message.
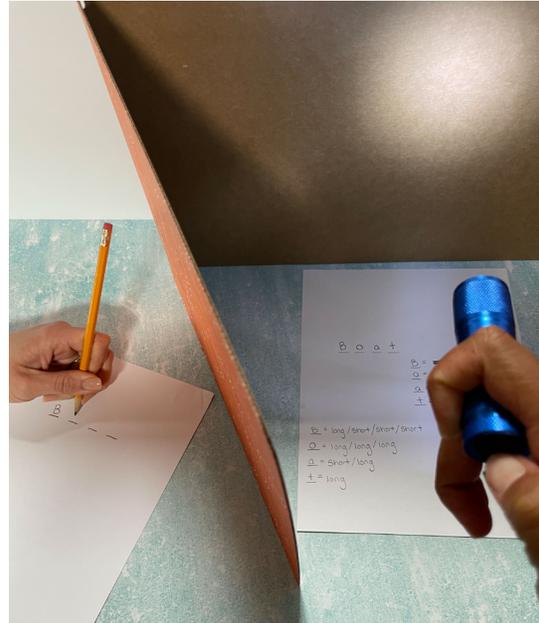
**5** Students will then gather together and will analyze how the original message is similar and/or different from the overall finished message.

**6** **To extend the activity:** Students should change jobs and then students should repeat steps 1-5. Have students create more complex messages to create more of a challenge.

Use this key for lights and sounds!

| Morse Symbol | Coder of Light | Coder of Sound |
|:---:|:---:|:---:|
| ● | Short Flash (1 second) | Knock |
| ▬ | Long Flash (2-3 seconds) | Clap |

# Computer Science Extension: Intro to Binary

Binary code allows us to give instructions to computers. Binary is a code just like Morse code but uses only 1's & 0's. Binary is based in math and increases in powers of 2. Ex: 1, 2, 4, 8, 16, 32, 64...Just like in regular math, the numbers further to the left have a greater value. See examples below:

If you were to type 11, the computer would understand it as one number 2 and one number 1, so it would read it as 2+1= 3

| 2 | 1 |
|---|---|
| 1 | 1 |

If you were to type 101, the computer would understand it as one number 4, zero number 2's and one number 1, so it would read it as 0+4+0+1= 5

| 4 | 2 | 1 |
|---|---|---|
| 1 | 0 | 1 |

If you were to type in the number 11101, the computer would understand it as one number 16, one number 8, one number 4, zero number 2's, and one number 1, so it would read it as 16+8+4+0+1= 29

| 16 | 8 | 4 | 2 | 1 |
|----|---|---|---|---|
| 1  | 1 | 1 | 0 | 1 |

# Vocabulary Terms:

- Strike: Amateur Radio
- Binary Code: A coding system using the binary digits 0 and 1 to represent a letter, digit, or other character in a computer or other electronic device.
- Frequency: The rate at which something occurs or is repeated over a particular period of time.
- Telegraph: A system for transmitting messages from a distance along a wire, especially one creating signals by making and breaking an electrical connection.
- Wavelength: The distance between successive crests of a wave, especially points in a sound wave or electromagnetic wave.

## Scientific Background:

Morse code is a method used in telecommunication to encode signals called dashes and dots. Morse code is named after Samuel Morse who was one of the inventors of the telegraph. A telegraph is an instrument that allows the transmission of information by coded signal over distance. The telegraph was a messaging system used from the 1840's until the late 20th century. To transmit messages across telegraphs, Morse code was created and used through telegraph wires. Morse code was developed so that operators could translate the indentations marked on paper tape into messages. Although telegraph wires were not available overseas, Morse code was still used as a line of communication between ships. The point of contact on a ship would use Morse code and different flashes of light to communicate to another ship that was in their horizon. Morse code became extremely important for the Navy during World War II and it helped improve the speed of communication between ships.

Binary code is a way of representing information using only two symbols: 0 and 1. Computers use binary code to perform all kinds of operations, from basic math to complex calculations. By manipulating binary digits using logic gates and circuits, computers can perform calculations, store and retrieve data, and execute programs. While it may seem strange at first, binary code is actually a very efficient way of representing information for computers, because it allows them to use electronic components that can be easily designed to switch on and off (or represent 0 and 1), using a tiny amount of power.

## STEM Related Career:

- Software Development Engineer
- Computer Programmer Analyst
- Security Software
- Ships Communication Officer

### Fun Fact!

Radio telegraphy using Morse code was used in the early part of the twentieth century for marine communication. In the 1970's a system was put into place where ship-to-ship or ship-to-shore communication was put into action instead of the use of a 24/7 radio operator. Marine communication between ships or with the shore was carried with the help of onboard systems through shore stations and even satellites.

# References:

Presently, the Navy still uses code in a line of communication. Below is a chart of a phonetic alphabet chart. The chart is a list of words used to identify letters in a message transmitted by radio or telephone. Spoken words from an approved list are substituted for letters. For example, the word "Navy" would be "November Alfa Victor Yankee" when spelled in the phonetic alphabet. This practice helps to prevent confusion between similar sounding letters, such as "m" and "n", and to clarify communications that may be garbled during transmission.

| Letter | World War II | 1957-Present |
|---|---|---|
| A | Afirm (Able) | Alfa |
| B | Baker | Bravo |
| C | Charlie | Charlie |
| D | Dog | Delta |
| E | Easy | Echo |
| F | Fox | Foxtrot |
| G | George | Golf |
| H | How | Hotel |
| I | Int (Item) | India |
| J | Jig | Juliett |
| K | King | Kilo |
| L | Love | Lima |
| M | Mike | Mike |
| N | Negat (Nan) | November |
| O | Option (Oboe) | Oscar |
| P | Prep (Peter) | Papa |
| Q | Queen | Quebec |
| R | Roger | Romeo |
| S | Sugar | Sierra |
| T | Tare | Tango |
| U | Uncle | Uniform |
| V | Victor | Victor |
| W | William | Whiskey |
| X | X-ray | X-ray |
| Y | Yoke | Yankee |
| Z | Zebra | Zulu |

**Extension Activity!**

Have students play telephone using the phonetic alphabet chart!

*"Woman using a Morse code radio communications device housed within an oak box."*

Strip as punched.



Message.

Interpretation.

A      T      A      N      Y
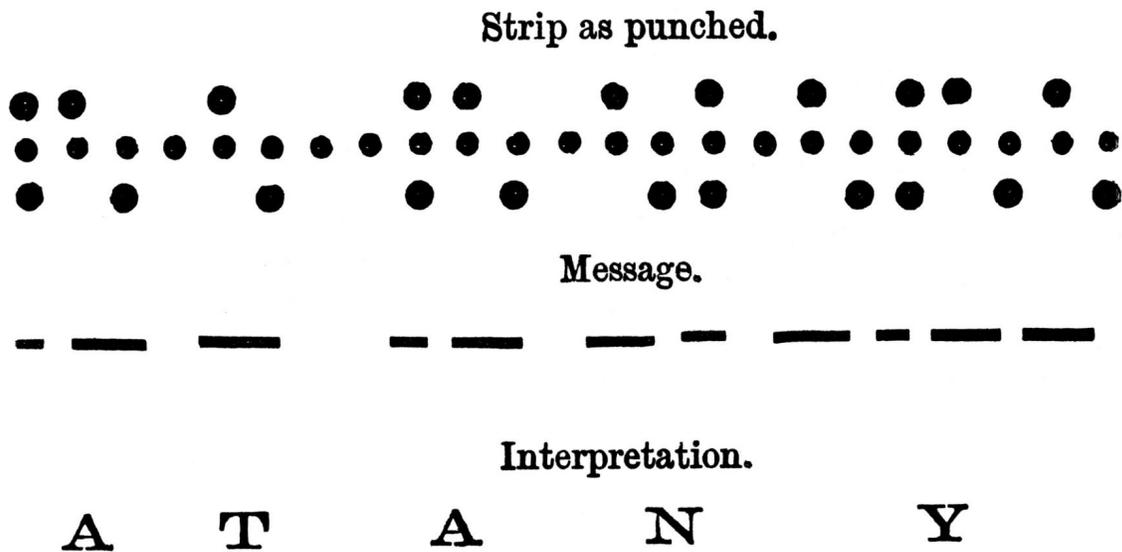
*"Telegraph example via Morse code"*

NAVSEA

SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS

# Morse Telephone Teacher Guide