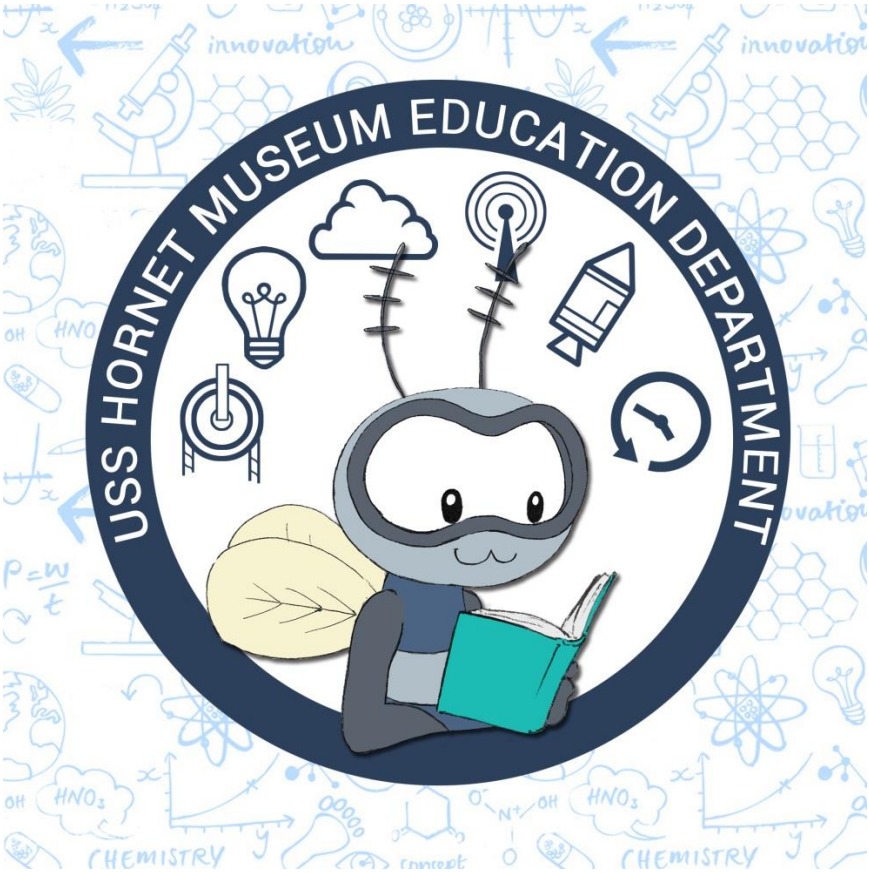

A Dot and Dash, a Ping and a Flash

Naval History and Non-verbal Communication

From the USS Hornet Museum Education Department

Alissa Doyle 2018

Alissa.Doyle@uss-hornet.org

About This Document

The history of naval communication relies heavily on the non-verbal and multi-sensory. Stripes or stars on an officer's uniform automatically dictated an enlisted man's actions, flashing lights relayed invaluable information to a landing pilot, and bells signaled between ships through an otherwise impenetrable fog. In this program, students will create a non-traditional form of communication, and in turn practice the basics of coding. They will direct another student through a changeable obstacle course using limited verbal directional cues, bells and whistles, or flashing lights, depending on what challenge they choose. The students will be required to come up with a set of simple instructions or a key to their chosen method of communication. This program allows students elementary age through high school to link the history of naval communication to modern technology.

Alissa Doyle, Lead Education Instructor

USS Hornet Museum Education Department

PO Box 460, Alameda CA 94501

uss-hornet.org

✉ edu@uss-hornet.org

facebook.com/USSHornetMuseumEDU

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Goals

In this program, students will:

- Work collaboratively to communicate using unconventional methods
- Engage in the engineering process as they create and employ a specific set of codes for navigating an obstacle course

Objectives

In this program, students will:

- Understand how and why the navy used such a variety of communication methods
- Link the various communication devices used in the navy with processes used in basic coding

Big Questions...and Answers

How do ships communicate with each other and their crew in total darkness?

Bells kept time, sounded alarms, signaled across distances and in changeable weather conditions. Sequential lights relayed specific instructions and messages, while over the last century, sonar and radar enabled electronic communication across the miles.

How do lights effectively direct an aircraft to land?

A Fresnel lens system on the Flight Deck told pilots what they needed to know before landing.

How do engineers solve a problem?

They come up with an idea, they create their idea, and then test it to determine its viability. This process is repeated indefinitely as they refine and perfect their idea.

Program Instructions

Program Timeline- 1 hour total-

Brief overview of the history of naval communication- 20 minutes

Brief overview of coding basics, activity description- 5 minutes

Code creation in small teams- 15 minutes

Team challenge -15 minutes

Debrief and discussion- 5 minutes

After learning about the various forms of non-verbal communication employed by the navy, students will get a chance to create their own method of communication. Students will work in teams to devise a method for directing one member of their team through an obstacle course or for deciphering a relayed non-verbal message.

Introduce students to the basics of coding:

- Coding relies on IF/THEN statements- IF you see a blue light, THEN you move forward.
- One person acts as THE PROGRAMMER, the other as THE COMPUTER. One is inputting information, while the other responds accordingly to the set of information received.
- Coding relies on patterns, repetition, and a highly specific set of formulas.

Ask students what similarities they see between naval communication and coding.

Have students work in teams of 3-5 individuals.

Suggested materials:

- 10-15 pens or pencils
- Paper

If focusing on visual communication or in darkness:

- 10-20 flashlights and/or laser pointers with beams of varying size, shape, and color
- This version of the program works best in a room of near or total darkness

- Give students a challenge like: relay a specific message to one half of your team using only flashes and colors of light; or, as the instructor, with a specific set of codes the entire group must learn, challenge them to decipher what you flash from across the room.

If focusing on auditory communication or in darkness:

- 5-10 bells, whistles, clickers, or other sound-producing objects
- Blindfold
- This can also be done with eyes closed and simple snapping and clapping
- Set up an obstacle course in your classroom space. This could be as simple as walking around a few chairs or tables, or following a taped path along the floor.

If focusing on basic coding and directional cues:

- Tape a path along the floor or make an obstacle course from tables and chairs, and have the COMPUTER (1 team member) follow the directions of the PROGRAMMERS (rest of the team) to get successfully around the room. Make sure the PROGRAMMERS limit their language to IF/THEN statements and directional cues only.

Regardless of the activity chosen, all should result in a different "code" being created by each team. If time allows, and each team has attempted to communicate amongst themselves, ask the teams to swap and try another team's code.

At the program's conclusion, wrap up by discussing the experience for the students as a whole:

- What was it like to eliminate one of the five senses?
- As THE COMPUTER, what did they find challenging?
- As THE PROGRAMMERS, what did they find challenging?
- Why do you think the navy developed such a range of communication tactics?
- As they explore the ship on their tour, notice all the ways colors, lights, sounds, etc. were- and are- employed to relay information around the ship.

USS Hornet Reference Material

Flight Deck (Fresnel Lenses)

- *How do pilots know if and where it is safe to land on an aircraft carrier?* A Fresnel Lens Optical Landing System on the portside of the flight deck provide a glide path for pilots approaching an aircraft carrier. An arrangement of center vertical light and accompanying horizontal lights on either side direct and signal a pilot as they approach the deck, letting them know if they are safe to land.

Suggested Questions

- *What color and light position did a pilot want/not want to see as they approached the flight deck?*
- *What would a pilot do if they were "waved off"?*
- *How do you know where to land in total darkness?*

Navigation (Pilot House & Bridge)

- *How to ships know where they are, and where they are going?* Many navigation and tracking methods were used on the ship: celestial navigation, dead reckoning, LORAN, radar, and sonar. These use observation, mathematics (vectors and other calculations), and physics (motion and wave mechanics).

Suggested Questions

- *How do you know where you are, and if any other vessels are nearby?*
- *How do you figure out how long it will take you to get somewhere?*
- *How do you find your way around if you can't see?*

Next Generation Science Standards

Grade Level	Standards
3-5	*Engineering Design:* 3-5-ETS1-2. Generate and compare multiple possible

	solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
6-8	*Waves and their Applications in Technologies for Information Transfer:* MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. *Wave Properties:* PS4.A A sound wave needs a medium through which it is transmitted. *Electromagnetic Radiation:* PS4.B When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. However, because light can travel through space, it cannot be a matter wave, like sound or water waves.

Appendix: Class Materials, Reference Items

Physical Qualifications of Lookouts

VISION. The first and fundamental physical qualification of a lookout is good day and night vision. The ability to sight objects during daytime, and at night depends partly upon training, and partly upon good vision. You must have both to qualify as a competent lookout.

HEARING. Satisfactory hearing is a requirement. When visibility is at a minimum, as during a heavy fog, keen hearing is tremendously important. Men posted as fog lookouts can often hear sounds from other ships, buoys, etc., before they can see them. Training in recognizing significant sounds at sea is important.

ENDURANCE. Keep in good physical shape! A tired lookout is an invitation to trouble for the whole ship. Fatigue is sure to interfere with your night vision. You owe it to your ship to be at your best.

Night Vision Technique

HOW TO USE YOUR EYES AT NIGHT. The business of being a lookout requires that you learn two methods of seeing which are quite different. Daylight searching uses the step-by-step method. In this method, the eyes are focused in a series of brief steps on certain areas or objects.

For night searching you must learn a brand new method which may seem strange at first.

HOW TO SEARCH AT NIGHT

When you look directly at the horizon on black nights, the horizon immediately in front of your eyes is actually not seen. Any object lying in this region will escape detection. This fact is very little appreciated by civilians, but it is one of the most important facts to on expert lookout searching at night.

The recommended technique of night scanning consists of the following: The lookout directs his eyes at levels about 10 degrees above or below the horizon. He does not sweep his eyes evenly over the area for which he is responsible, but moves them in short jumps of about 10 degrees to 15 degrees, with momentary fixation pauses, to search the sky or horizon systematically and to be alert for objects in the "corners of the eyes." This may involve slight movements of the head as well as movements of the eyes. The lookout should be cautioned to direct his vision in quick jumps with short fixation pauses, and not keep staring at any one place for a long period of time. Nothing can be seen while the eyes are actually in motion, but they are most sensitive just after being moved. When an object is suspected in a particular area the lookout should "scan" this area, moving his eyes in short jumps from 10 degrees on the right side of the object, to 10 degrees above, to 10 degrees on the left side - until more complete identification is made. This technique does not come naturally to most people, and therefore must be practiced conscientiously. Your "night eyes" are sensitive to

very dim light, but they are even more sensitive to motion. Therefore, your night eyes detect moving objects much more readily than they detect stationary ones.

As you know, when using binoculars in the daytime, you look straight through them. But when using binoculars on dark nights, a different method is necessary. Hold them up to your eyes, but direct your gaze downward, below the binocular field. You will find that you can see more clearly this way, because of the peculiar characteristics of night vision.

DARK ADAPTING YOUR EYES

If you were to go on night watch direct from a lighted compartment, you would find that you would be almost blind for a few minutes. Gradually your vision would improve as your eyes become accustomed to weak light. After 10 minutes, you would be able to see fairly well. It would take 30 minutes, however, before you would reach your best night vision. This improvement of vision in dim light is adaptation to darkness, usually called dark adaptation.

An improved method of adapting your eyes to darkness is to wear special red goggles for half an hour prior to going on watch. They adapt your eyes to darkness while you wear them.

The goggles with which the Navy supplies you are especially designed for dark adaptation. While wearing them under ordinary white light, you can play games, write letters, or read almost as comfortably as you could without them.

Although you have worn dark-adaptation goggles half an hour before going on watch, it still takes at least 5 minutes more in darkness before you have developed your best night vision. Therefore, never relieve the watch until you have actually been at your station in actual darkness for at least 5 minutes. This is in addition to the 30 minute period during which dark-adaptation goggles are worn.

WHEN TO PUT ON DARK-ADAPTATION GOGGLES

When you are awakened for a night watch, put on your dark-adaptation goggles immediately, even before you open your eyes. This prevents your eyes from losing the adaptation to darkness which they have acquired while they were closed during sleep. If it is necessary for you to visit a lighted compartment, or look at anything under any but red light, always put on your dark-adaptation goggles first.

PROTECTING DARK ADAPTATION WITH RED LIGHT

Quartermasters have to make numerous entries in their notebooks during night watch. If these entries must be made on the bridge the light from a flashlight with a red lens will give sufficient illumination. Never use a white light, for it will destroy your dark adaptation. Of course no one should ever use any flashlight - red or white - in such a way that the enemy could glimpse its direct light, or even its light reflected from some object.

HINTS ON SPOTTING SHIPS AT NIGHT

As a good lookout, you must know how enemy ships are apt to disclose themselves. For example, when the moon is either rising or setting, a ship which happens to cross between you and the moon will be silhouetted for a short time. In much the same way, a ship passing between you and coastal lights may disclose itself by blocking out a portion of them.

Watch reflections of the moon or a bright star. A ship crossing the path of reflected light will appear as a dark object which interrupts the normal motion of the light reflected from the waves.

On a night "so black that you cannot see your hand in front of your face," it is still possible to detect ships by the phosphorescence they stir up. Phosphorescence is often very prominent in the bow wave, in the wash along-side the ship, and in the wake. Very often, single flashes of light may be caused by a distant ship striking a patch of very bright phosphorescence.

Under certain conditions a distant fog bank or a low lying bank of clouds may appear lighter than the water or sky. When this occurs, a ship may be silhouetted against it.

Under different conditions, a ship may pick up enough light from stars or moon to appear as a light object against a very dark background. You will see such ships only when the moon or bright stars are in back of you, since only at this time will enough light strike the side of the ship visible to you.

GENERAL RULES FOR SEEING AT NIGHT

The experienced lookout knows how to use the brain as well as the eyes. As a lookout, your value to your ship will depend on remembering and using the following important rules:

1. Be dark adapted before assuming duties as lookout at night.

2. Use red light only at night.

3. Wear your dark-adaptation goggles when entering a lighted compartment at night.

4. When dark adapted, avoid all light other than red.

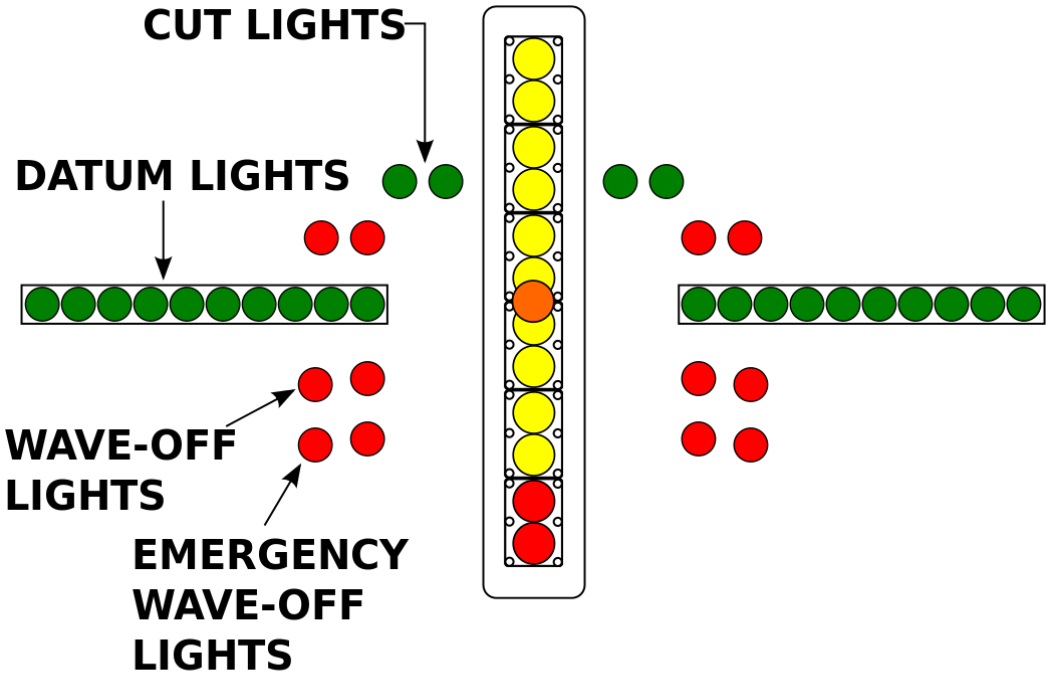
5. Keep optical equipment clean.

6. Know your eyepiece settings and interpupillary distance, for properly setting and focusing binoculars.

7. Search assigned area using night search method of off-center vision.

8. Keep in good physical condition. Fatigue is sure to interfere with your night vision.

FRESNEL LENS DIAGRAM



Mid	Morning	Forenoon	Afternoon	Dogs*	First
0030 - 1 bell	0430 - 1 bell	0830 - 1 bell	1230 - 1 bell	1630 - 1 bell	2030 - 1 bell

0100 - 2 bells	0500 - 2 bells	0900 - 2 bells	1300 - 2 bells	1700 - 2 bells	2100 - 2 bells
0130 - 3 bells	0530 - 3 bells	0930 - 3 bells	1330 - 3 bells	1730 - 3 bells	2130 - 3 bells
0200 - 4 bells	0600 - 4 bells	1000 - 4 bells	1400 - 4 bells	1800 - 4 bells	2200 - 4 bells
0230 - 5 bells	0630 - 5 bells	1030 - 5 bells	1430 - 5 bells	1830 - 5 bells	2230 - 5 bells
0300 - 6 bells	0700 - 6 bells	1100 - 6 bells	1500 - 6 bells	1900 - 6 bells	2300 - 6 bells
0330 - 7 bells	0730 - 7 bells	1130 - 7 bells	1530 - 7 bells	1930 - 7 bells	2330 - 7 bells
0400 - 8 bells**	0800 - 8 bells	1200 - 8 bells	1600 - 8 bells	2000 - 8 bells	2400 - 8 bells

Links and Credits

Docent Scott Zirger has created a wiki for the ship containing a wealth of information:
https://en.wikipedia.org/wiki/User:Szirger/Books/USS_Hornet_Reference_Material

This program was created in conjunction with a grant from the Office of Naval Research, and expands upon ideas found in the following lesson:
http://usnavymuseum.org/Education_LP0012.asp

US Naval Lookout Manual 1943:

https://www.history.navy.mil/research/library/online-reading-room/title-list-alphabetically/l/lookout-manual-1943.html

http://www.navy.mil/navydata/questions/bells.html

Aircraft Carrier Landings: "Fresnel Lens Optical Landing System" (FLOLS) 1968 US Navy Training Film
https://www.youtube.com/watch?v=7C08dr2oOug&t=299s