GRADES 6-12

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USS CLEVELAND LEGACY FOUNDATION

STEAM STARS

MODULE 4 LESSON GUIDE // U.S. NAVY INFORMATION WARFARE

USS CLEVELAND LEGACY FOUNDATION STEAM STARS PROGRAM

LESSON OVERVIEW

This lesson introduces Information Warfare specialties in the U.S. Navy, including an overview on these groups, and how personnel in these fields use STEAM in their daily operations. The lesson highlights various STEAM careers, and guides students to forming teams and choosing the path that aligns with their personal strengths and interests. Students will work in teams in a simulated mission to develop or use naval information systems to protect and rescue their city, achieving educational outcomes as they see how science, technology, engineering, art, and math are used by the Navy to keep our nation safe.

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LESSON TITLE

U.S. Navy Information Warfare

TIME

50-150 min 1 class for Presentation and 1 Station
Optional - 1 class for 2 additional Station rotations
Optional - 1 class for 1 final Station rotation and Discussion

LEARNING OBJECTIVES

Students will:

- Discover a variety of STEAM careers in the U.S. Navy.
- Learn how STEAM is used by the Navy to keep our nation safe.
- Learn and practice Binary code, a cryptologic fundamental.
- Learn and gain proficiency in a typical solderless breadboard exercise. Students will understand the internal connections, and understand how to wire digital circuits with increasing complexity.
- Use visual and critical thinking skills in a mock intelligence gathering exercise.
- Learn why meteorologists are important to military operations. Build and test their own scientific instrument for measuring wind speed.

NEXT GEN SCIENCE STANDARDS (NGSS)

This lesson helps students prepare for these Next Generation Science Standards Performance Expectations:

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

HS–PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

ACTIVITY SOURCES

- The Cyber Innovation Center https://cyber.org/breadboard
- CIA.gov https://www.cia.gov/spy-kids/games/
- Frugal Fun for Boys and Girls https://frugalfun4boys.com/make-an-anemometer-to-observe-wind-speed/

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MATERIALS AND EQUIPMENT LIST

1. Module 4 Presentation
    - ☐ M4 U.S. Navy Information Warfare slidedeck
        - ☐ Embedded Video (Slide 5): Navy Cryptologic Technician Collection – CTR (1:12)
        - ☐ Embedded Video (Slide 7): Navy Cryptologic Technician Maintenance – CTM (1:17)
        - ☐ Embedded Video (Slide 9): Navy Intelligence Specialist – IS (1:42)
        - ☐ Embedded Video (Slide 11): Navy Aerographer's Mate - AG (2:23)
2. Activity Stations
    - ☐ Activity Station Printables
    - ☐ 10 - Cyber.org DIY Breadboard Circuit Kit (Station 2 "Short Circuit")
    - ☐ Supplies for Station 4 "Storm Chasers":
        - ☐ Scissors
        - ☐ Single Hole Punch
        - ☐ Masking Tape
        - ☐ Nail
        - ☐ Access to a portable Stopwatch or Timer (like on a Smartphone)

      For each anemometer, you'll need:
        - ☐ 4 - Plastic drinking straws
        - ☐ 4 - Small (3 oz) plastic or paper cups
        - ☐ 1 - Pencil with a new eraser
        - ☐ 1 - Tack or Straight Pin

STUDENT ACTIVITY SHEETS/HANDOUTS

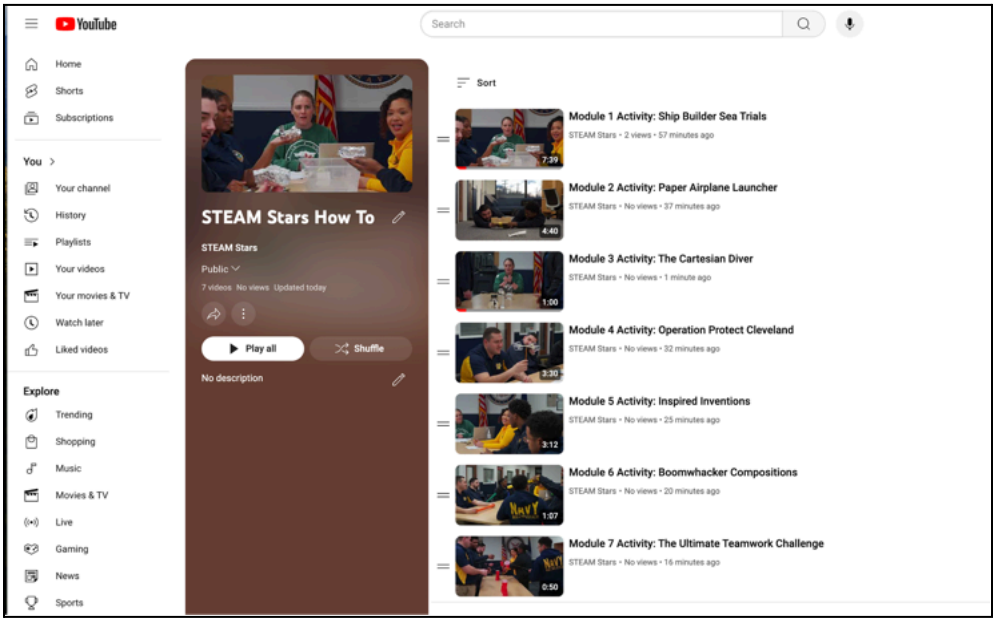
- ☐ Activity Station Signs
- ☐ Activity Station Mission Instructions
- ☐ Station 1 Activity Worksheet
- ☐ Station 1 Activity Answer Key
- ☐ Station 2 Activity Worksheet
- ☐ Station 3 Activity Worksheet
- ☐ Station 3 Activity Answer Key
- ☐ Station 4 Activity Worksheet

TECHNOLOGY TOOLS

- ☐ Digital display projector with internet access
- ☐ Ability to project and play Google Slides and YouTube videos with sound
- ☐ Printer/Copier
- ☐ Portable stopwatch or timer

PREP WORK

- ☐ Test slide deck, embedded videos. Video links provided above if needed.
- ☐ Set up the classroom into 4 stations (Ideally, students can sit and work together as a team, but an alternative option could be to have 4 stations in front where students can get their assignment (read their mission) and pick up their materials, then each take back to their desk to work independently).
- ☐ Print station signs.
- ☐ Print all Activity Worksheets. (NOTES: Some will need to be printed in color. Print enough for every student in the classroom.)
- ☐ Pre-sort materials for each group.
- ☐ Go to the @USSCLF-STEAMStars YouTube to watch helpful How-To videos!

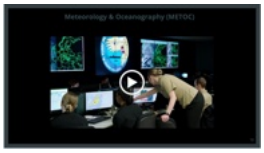


PROCEDURE PART 1: PRESENTATION

Module 4 - U.S. Navy Information Warfare

Slide 1. 	
Slide 2. 	Did you know? The Navy first recruited cryptanalysts by hiding puzzles in their monthly Communications Bulletins! Throughout the 1920s, Cadets who sent in successful solutions were recruited to a special school, and from 1928 to 1941, the Navy graduated 176 Sailors and Marines who were the first enlisted radio operators and formed the vanguard of naval cryptology, what the Navy calls its Information Warfare Community today (or IWC). This community was critical to our nation's success in WW2, with nearly 10,000 naval cryptologists used in nearly every major campaign in the war. When you think of military teams and systems, we often envision the weapons and soldiers used on the front lines. But WW2 proved how important information and security was to winning battles.
Slide 3. 	Historically, information warfare was born on code breaking and spies. Today, information warfighters execute the full spectrum of cyber, cryptology, signals intelligence, information operations, computer network operations and electronic warfare missions. They operate afloat and ashore and serve at the National Security Agency, the Pentagon, Navy information operations commands and regional cryptologic centers across the globe. They are experts in technology, people, and our earth, and are trained in over 100 languages, dialects, and foreign cultures.
Slide 4. 	Information saves lives and wins wars. This quote from the Department of the Navy puts it well, that, "As an information age military, every warfighting function and mission area entirely depends on information and rapid decision-making... Information is Combat Power." Today we're going to learn a little bit about how the Navy uses STEAM - Science, Technology, Engineering, Arts, and Math – in its Information Warfare Community.
Slide 5.	Today's Information Warfare Community is split into four main specialties: • Cryptologic Warfare and Cyber Warfare Engineer

	• Information Professional • Naval Intelligence, and • Meteorology and Oceanography In each specialty, there are many jobs, so today we're just going to have an overview and look at a few that use STEAM. As you watch some of the videos and learn about these fields, think about which specialty is most interesting to you. You'll see why at the end of the presentation!
Slide 6. 	(Run time: 1:12)
Slide 7. 	Cryptologic Warfare & Cyber Warfare Engineers are the Navy's experts in cryptology, space, signals intelligence, cyberspace operations, and electronic warfare. They are referred to internally as "Spooks." Since everything they do is classified, we don't really know exactly what they do, but we hear it's really cool! This group also includes the "Hackers of the Navy" - those who use hacking skills to obtain information for our government, while protecting others from getting into our systems. Did you know our Navy has hackers? In fact, for the past couple of years, the Navy has sponsored their own "hackathon" event called "Hack the Machine" for coders and hackers to test their defense systems and compete for prizes, such as money and contracts. They know that in order to stay ahead of enemy attacks, they need to make sure our systems and people are the best of the best!
Slide 8. 	(Run time: 1:17)
Slide 9. 	Information Professionals are the I.T. people of the Navy, who manage the communication operations and networks aboard Navy vessels. They play a vital role in everything from email systems to special intelligence and information warfare systems. They develop and deploy information systems, command and control and space systems, and assist with top secret cyber warfare missions.

Slide 10. 	(Run time: 1:42)
Slide 11. 	Naval Intelligence are “The Painters” – they paint the big picture by taking information from multiple sources (classified and unclassified) and fusing them together. They monitor and analyze maritime activities that pose a threat to national security, such as drug smuggling, illegal immigration, arms transfers, environmental mishaps and violations of UN sanctions. They are responsible for delivering real-time operational intelligence assessment to high-level decision makers. And they plan intelligence operations including threat analysis for pre-strike missions and direct action missions.
Slide 12. 	(Run time: 2:23)
Slide 13. 	Meteorology & Oceanography, or METOC (pronounced ME-TOCK) personnel apply expertise in all facets of oceanography, meteorology, hydrography and precise time and astronomy as they: • Handle environmental predictions from space all the way to the ocean floor • Help guide ships, aircraft and troops with recommendations based on weather forecasts and ocean conditions • Relay forecast updates and weather warnings to military and civilian authorities • Prepare ocean, sea and waterway charts and maps for anything from basic navigation to search-and-rescue efforts, and • Maintain the military's primary master clock, which provides the most precise time interval in the world and drives the Global Positioning System (GPS) They are the forecasters and timekeepers for the Navy. Which turns out to be a very important job not only for wartime efforts, but used everyday for training, daily operations, disaster relief, and in general to protect our country and our troops.
Slide 14.	In this lesson, we learned about the Navy’s Information Warfare Community, and how it’s divided into four specialties. For our activity, we have four stations and you will pick your first station (and your team for the day) based on which

specialty you felt was the most interesting to you! So what specialty are YOU interested in? That answer will help guide you to your first station, and your team. Then we'll rotate teams through to the other stations so you can try them all. Ready? I'll do a quick recap of the specialties...

The first group we learned about was the Cryptologic Warfare & Cyber Warfare Engineers - these are the codebreakers and the hackers of the Navy. If you like video games, puzzles, are pretty good at math and spotting patterns, go to Station 1, Code Warriors.

The second is Information Professional. These are the IT systems maintenance technicians of the Navy. If you are naturally handy, or think you'd like working with tools, or with electronics; or if you're the type of person who wouldn't be afraid to take a cell phone or computer apart and put it back together again, go to Station 2, Short Circuit.

Next is Naval Intelligence. This group specializes in looking at the big picture AND the details. They have really good critical thinking skills and a good eye. If you like travel, fashion, music– that means you appreciate culture, could be good at learning foreign languages, and spotting trends. Or maybe you're very organized, or just great at keeping secrets. If this sounds like you, go to Station 3, I Spy.

Lastly, Meteorology and Oceanography. They are the forecasters and the timekeepers for the Navy. If you're interested in environmental science, love to play outside, go on hikes or be out in nature; go to Station 4: Storm Chasers.

Now go to your station, find your team and complete your mission!

PROCEDURE PART 2: ACTIVITY

Operation Protect Cleveland

Procedure

Try to allow students to stay in teams, even if they are disproportionate in size. Group size shouldn't affect the time it takes to complete the tasks at each station. Only rearrange students into different teams if needed for logistics (i.e., space at the stations to gather).

Help students move quickly to stations. Instruct them to read the "Mission Brief" for their assignment. Then they should each take a worksheet (and materials, if needed). Students will need to have something to write with.

**** OPTIONS TO ADJUST THIS LESSON FOR TIME ****

Each station should take around 25 minutes, with a 5 minute transition time for teams to move to the next station. Options to break up the lesson for time:

- In 1 50-minute period: Teams will only choose ONE station to complete.
- In 2 50-minute periods: Teams will end the first period after the first station. They will complete 2 stations in the second period (rotating through 3 stations total per team).
- Another option in 2 50-minute periods: Teams will end the first period after the first station. For the second period, allow students to work at their own pace through the rest of the stations to see if they can complete them all in the time allowed.
- In 3 50-minute periods: Teams will end the first period after the first station. They will complete 2 stations in the second period. They will complete the last station in the third period. Teacher will conclude with the Post-Activity Discussion Questions.

STATION 1 ACTIVITY: Code Warriors

Set up the station:

1. Station 1 Sign
2. Station 1 Activity Mission Instructions
3. Station 1 Worksheet (Single-Sided)

STATION 2 ACTIVITY: Short Circuit

Set up the station:

4. Station 2 Sign
5. Station 2 Activity Mission Instructions
6. Station 2 Worksheet (Double-Sided in Color)
7. 8-qty Cyber.org DIY Breadboard Circuit Kits

STATION 3 ACTIVITY: I Spy

Set up the station:

8. Station 3 Sign
9. Station 3 Activity Mission Instructions
10. Station 3 Worksheet (Double-Sided in Color)

STATION 4 ACTIVITY: Storm Chasers

Set up the station:

11. Station 4 Sign
12. Station 4 Activity Mission Instructions
13. Station 4 Worksheet (Double-Sided in Color)
14. Computer, tablet, or smartphone with internet access
15. Set out materials and supplies:
    a. Scissors
    b. Single Hole Punch
    c. Masking Tape
    d. Nail
    e. Stopwatch or Timer (like on a Smartphone)
    f. Plastic drinking straws
    g. Small (3 oz) plastic or paper cups
    h. New Pencils (unsharpened, must have new eraser)
    i. Straight Pins

PROCEDURE PART 3: DISCUSSION

Post Activity Discussion / Wrap Up

Have one student from each station/team summarize their mission and their activity. What did you do? What is something that you learned?