



North American Marine Environment Protection Association



# Marine Industry Learning Guide

Interactive lessons for educators, seafarers, and the public



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# MARINE INDUSTRY LEARNING GUIDE

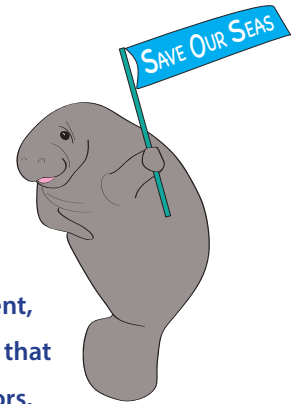
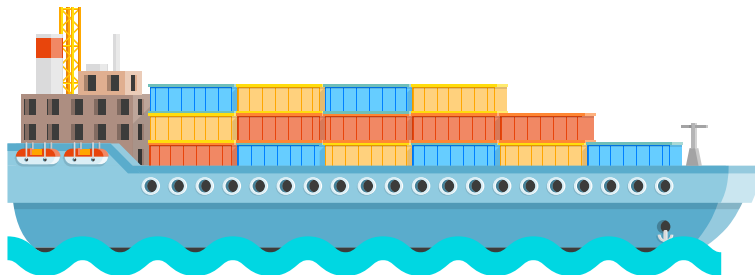
## INTRODUCTION

Ninety percent (90%) of all consumer goods have spent some part of their journey on a ship, making the marine industry one of the primary drivers of globalization and trade. Vessels move cargo around the world in far greater volumes more efficiently, safely and with a lower environmental impact than any other mode of transportation. Ships transport all sorts of commodities such as grains and fruit, liquefied natural gas (LNG), coal and petroleum oil for energy production, raw materials, clothing, cars and electronics, and so much more. Ships are also popular for vacations; the cruise industry alone carries millions of passengers and generates billions of dollars in revenue every year. Ferries provide terrific options for commuting and help reduce road congestion.

The success of the marine industry is based on the supply and demand of goods from around the world. Advances in technologies, such as the development of faster and lighter ships, the construction of canals, and improvements in navigational systems have improved the overall operation of the industry. These advancements have made it easier, more efficient and safer for crews, the environment, and ships to move cargos.

For the purposes of this learning guide, the marine industry is being defined to include any economic activity of or relating to the oceans, rivers, and the Great Lakes. This includes traditional maritime activities such as designing, constructing, manufacturing, supplying, maintaining vessels or parts, operating and managing shipping lines, or crewing ships. It can also include engaging in maritime law, brokerage services, insurance, customs services, fishing operations, marine science, salvage operations and the operation of ports, shipyards, drydocks, and cruise lines. Additionally, the exploration for and exploitation of both offshore renewable and nonrenewable energy sources are included in the marine industry.

NAMEPA's goals include increasing the public's awareness of the marine industry and the industry's dedication to the health and safety of its crew, the environment and its fleet. Through the use of this guide, readers can learn to appreciate and understand the importance the marine industry and how the people working in it affect everyday lives. It may even spark a desire to become a part of this vibrant, global industry!



**The North American Marine Environment Protection Association (NAMEPA) is an independent, marine industry-led entity that engages industry, regulators, environmental groups, educators and the public by promoting sound environmental practices. NAMEPA is a non-profit organization committed to "Save Our Seas" and preserving the marine environment through educating seafarers, students and the public about the need, and strategies for, protecting global ocean resources.**

**This easy-to-use guide is designed to provide maximum flexibility for learners in both formal and informal settings. It may be used as a standalone teaching tool, or to supplement lessons in other areas. This guide includes information about the marine industry with useful lessons for students in grades K-12 with a focus on STEM (Science, Technology, Engineering, Mathematics) objectives and alignment to NGSS (Next Generation Science Standards).**

To access resources referenced in this guide and for additional information, visit [www.namepa.net/education](http://www.namepa.net/education).



# WHAT FLOATS YOUR BOAT?

## INTRODUCTION TO THE PARTS OF A BOAT AND THEIR USES

**GRADE: K-5**

**TIME: 30-45 MIN**

### SUMMARY

In this lesson, students will be introduced to the parts of a ship and their correct names. Students will begin to understand the scientific principle of buoyancy and how the different parts of the ship are necessary to make the ship float. In the end, students will use the information obtained to create a ship out of aluminum foil that is capable of floating and carrying a "cargo."

### OBJECTIVES

Students will:

1. Identify the parts of a ship and their proper names.
2. Understand the basic scientific principle of buoyancy.
3. Engineer a ship out of household materials based on scientific investigation.

### STEM APPLICATIONS

Science, Engineering, and Math

### NGSS ALIGNMENT

**K-2-ETS1-2.** Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

**K-2-ETS1-3.** Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

**2-PS1-1.** Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

**2-PS1-2.** Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

### VOCABULARY

**Anchor** – large hook attached to the ship which is cast overboard and digs into the sea bed to keep the ship from moving.

**Bow** – the front of the vessel.

**Bowsprit** – spar attached at an angle to the bow of a ship, used to hold jibs.

**Buoyancy** – the ability of an object to float in a liquid.

**Fore and aft** – from the bow to the stern; fore is towards the front; aft is towards the back.

**Hull** – the main body of the ship.

**Keel** – the timber at the very bottom of the hull that runs from the bow to the stern; often called the ship's "backbone."

**Line** – a sailor's word for a rope.

**Mast** – a large wooden spar used to hold up other spars and rigging.

**Port** – the left side of the ship when facing the bow.

**Rigging** – the lines that support the masts and move the sails.

**Rudder** – a blade attached under the stern used for steering.

**Sails - types of:**

**Jibs** – triangular sails at the front of the ship; attached to the bowsprit.

**Square sails** – rectangular sails that are placed square or perpendicular to the keel.

**Main sails** – the lowest sails.

**Top sails** – the next level of sails above the main sails.

**Stern** – the back of the ship.

**Topgallant (pronounced t'gallant)** – the third sail or set of sails from the bottom, above the topsail.

**Spanker** – the biggest sail at the stern of the ship.

**Shrouds** – heavy lines which hold up the masts from the sides of the vessel.

**Starboard** – the right side of the vessel when facing the bow.

**Spar** – long pieces of wood used to support the sails and rigging. The bowsprit, masts, and yards are all spars.

**Yards** – horizontal spars that hold square sails.

### MATERIALS

1. "Labeling a Ship" PowerPoint
2. Ship design challenge instructions
3. Aluminum foil
4. Popsicle sticks (20 per group)
5. Uncooked pasta e.g. rigatoni or penne (20 per group)
6. White glue (one per group)
7. Masking tape (one per group)
8. Pennies (40+)
9. Medium to large sized tubs of water (1-3 gallons)

### BACKGROUND

Amazingly, over 50% of the global population lives within two miles of a body of water. That means ships are all around us! For thousands of years, ships have allowed us to enjoy the beauty of being on the water and adventure to new places. The first known floating vessels were used around 10,000 BC, but it wasn't until 3,000 BC that Egyptians and Mesopotamians started building rafts for trade and transport. Ships have come a long way since then; modern ships are capable of traveling for thousands of miles with several tons of cargo.

Buoyancy is the ability of an object to float based on its tendency to float or rise in liquid. An object that floats in water is positively buoyant, while an object that sinks is negatively buoyant. This is related to the object's mass and volume relationship called its density. When an object is placed in water, a certain amount of water is displaced. The object will sink until the object displaces the amount of water that is equivalent to

the object's mass. Boats and ships partly float and partly sink depending on their masses. For example, an object with a mass of 1 gram will displace 1 gram of water. If the object is less dense than the liquid it is placed in, it will float. However, if the object is denser than the liquid, it will sink. Since water has a high density, it is capable of holding a large weight like a cargo ship! Buoyancy is also related to the force of gravity pushing down on an object in water while a buoyant force acts upwards on the object, preventing it from capsizing. Ships are also equipped with ballast water tanks to adjust the weight of the vessel at port by loading and unloading excess water. This keeps the vessel from floating or sinking too much.

This lesson will help students learn the parts of a ship and how they function to keep the vessel afloat. Students will gain an appreciation for the scientific principles that allow ships to float, and use that knowledge to design a ship to carry the most weight.

## ACTIVITY

### 1. Engage/Elicit

Every activity has a specific set of vocabulary that goes along with it; the same holds true for the shipping industry. Boating and sailing have a unique set of terms that allow the members of the crew and the passengers to communicate. This vocabulary will help you to better understand the maritime industry.

Introduce each word in the vocabulary by using the associated "Parts of a Ship" PowerPoint to clearly identify the parts of a boat.

Ask students about their own personal experiences with a boat or ship. How did their boat move in the water? How do they think it stayed afloat? Define and explain buoyancy. Buoyancy is the upward force of the water pushing on the ship, keeping it on top of the water. A ship will stay afloat if the weight of the water displaced is greater than the weight of the ship, which makes it easier for that upward force to keep it afloat! Explain that marine organisms have internal neutral buoyancy, and humans can manipulate buoyancy while SCUBA diving.

Demonstrate the concept of buoyancy using two pieces of aluminum foil. Ask students if they think the aluminum foil will sink or float when placed on the water. Give the students time to discuss and explain their answers.

Place one flat, unbent sheet of aluminum foil on the water and then ask the students if they can figure out a way that the second sheet of aluminum foil would sink instead of float.

Crumple the second sheet of aluminum foil into a ball and place it in the water. Ask the students to explain why they think the second sheet sinks, reminding them it is the same material. Review the concept of water displacement as you demonstrate.

### 2. Explore

Students should be split into groups of three or four and given the supplies for the "Ship Design" challenge. Based on vocabulary they have learned and the discussions about buoyancy and water displacement, students will be charged with designing a boat out of household items that will float but will then also be able to hold the most "cargo" (pennies). Students design and create the ships using the supplies and then test their ships in the water.

### 3. Explain

As students are building their designs and perfecting them through trial and error, explain the principles of buoyancy and what affects the ship's ability to float in the water.

### 4. Evaluate/Wrap-up

To wrap-up this activity, have the students all make final changes to their designs and see how much weight their ship design can support before sinking. Count the number of pennies each ship could support to determine the winner! Have them discuss what they did to make their ship so strong and supportive.

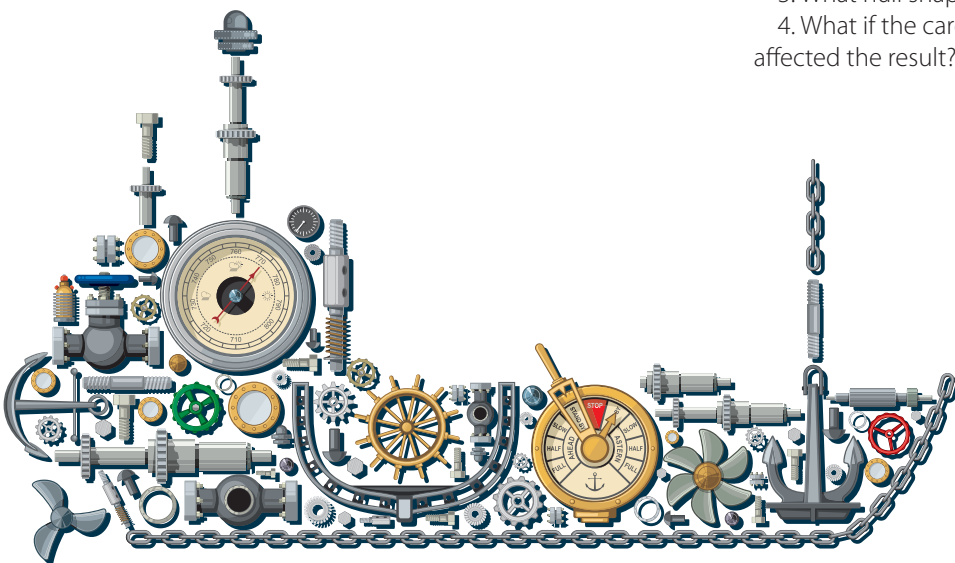
Ask students these questions about the lesson and activity:

1. What was the hardest part of this activity? The easiest?
2. How many times did you have to test your design before it was finally able to float?
3. What hull shape did you use? Did it work well?
4. What if the cargo was a different material? Would it have affected the result?

## DIVE DEEPER

This lesson was adapted from the "Build a Boat" lesson published by [www.educationworld.com](http://www.educationworld.com)

Want to know more about buoyancy and density and the relationship between the two? Or how heavy ships float? Visit <http://boatsafe.com/kids/021598kidsques.htm> to find out! For more activities and information about ships and the marine industry, please visit [namepa.net/education](http://namepa.net/education).





# TYPES OF SHIPS

## IDENTIFYING THE TYPES OF VESSELS AND THEIR USES

**GRADE: K-5**

**TIME: 20-45 MIN**

### SUMMARY

Ships are a central component to the marine industry. In this lesson, students will be introduced to the major types of ships that exist in the marine industry and to the purpose each ship serves. Students will learn the major exports of different countries around the globe and will understand what is required for a ship to get these exports to their destinations.

### OBJECTIVES

Students will:

1. Identify the different types of ships in the marine industry and the purpose for each.
2. Recognize cargo types and determine from what country they might originate.
3. Understand and appreciate that the shipping industry has global impacts, and that items we use every day travel far and wide before arriving at their destination.

### STEM APPLICATIONS

Technology, Engineering, Math

### NGSS

**5-PS1-3.** Make observations and measurements to identify materials based on their properties.

**2-PS1-2.** Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

**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.

### VOCABULARY

**Bulk** – Goods carried in large amounts.

**Cargo** – goods carried on a ship.

**Vessel** – A large ship with a hollow container used to carry cargo or liquid.

**Export** – To carry goods to another country for sale.

**Import** – To carry goods from another country for sale.

**Economy** – The wealth and resources of a country or region.

### MATERIALS

1. "Types of Ships" PowerPoint presentation
2. "Cargo Match" ship cards
3. Country exports power point

### BACKGROUND

Ships allow different countries to connect by means of trade. It is important for students to understand how these goods are moved from port to port. Ships are incredible feats of technological advancement and each ship is designed for a particular type of cargo. Ninety percent (90%) of goods that humans use are transported by ships. Ships are also used to transport people. They are used for recreational and commercial fishing, and for scientific research.

There are over one hundred descriptions of ship types, but for the sake of this lesson, they have been grouped into twelve main types of ships. These are described on the "Types of Ships" PowerPoint used with this lesson. Ships in the marine industry include everything from container ships to tugboats! All types are important when it comes to keeping the industry moving and delivering people and goods safely and on time.



## ACTIVITY

### 1. Engage/Elicit

Before starting the "Types of Ships" PowerPoint, ask the students questions about the different types of ships that exist. For example, you might ask them:

1. How many different kinds of ships are there?
2. Which types can you name?
3. What do ships transport?
4. What is the difference between exports and imports?

Students should be thinking now about the answers to these questions. Have them look at items around the classroom to see where they come from. Many items will have labels stating where they were made. How did they get all the way here?

### 2. Explore

Go through the "Types of Ships" PowerPoint with the students. Engage the students by asking if they have ever seen any of the ships before. The ships most students have experience with are usually passenger ships (cruise boats and ferries) and tugboats. Both of these ships are important to the industry as well, as explained in the slides of the presentation. Encourage the students to talk about what the ship is used for and why its shape and design makes sense for its specific purpose; compare and contrast ships as you go through the slides. You can find other examples of ships on the Internet. Some helpful websites include:

- <http://www.shipspotting.com/gallery/categories.php>
- <http://www.marinetraffic.com/en/photos/of/ships>
- <http://www.fotoflite.com> (under "ship types")

### 3. Explain

After going through the "Types of Ships" PowerPoint, play the "Cargo Match" game. Split students into groups of three. Hand out "ship cards". Ask the students the questions at the end of the PowerPoint. For example: "Which ship would carry people?" Students should hold up the picture of the cruise ship. Continue until you have gone through the entire list.



### 4. Extend

Once finished playing "Cargo Match," show the students the picture of the world and the exports that come from each country. Show the students the different exports and have them guess what type of ship would carry that export.

### 5. Evaluate/Wrap-up

Conclude the activity by asking the students the questions posed at the beginning of the lesson to gauge how their answers changed. How has their understanding of the importance ships grown?

1. How many different kinds of ships are there?
2. Which types can you name?
3. What do ships transport?

Remind the students that 90% of everything is transported by ships, and without them, our way of life would be much different.

## DIVE DEEPER

Ever wonder what it is like to live on board a ship that travels far and wide across the sea? Visit <http://www.captainmcd.com/id5.html> to hear stories from Captain McDonnell who has 30 years of sailing experience!

For more design thinking activities or to participate in the Day of Design, visit Jason Learning's webpage: <https://www.jason.org/day-of-design>.

For more activities and information about ships and the marine industry, please visit <http://www.namepa.net/education>.

### "Cargo Match" ship cards ANSWER KEY:

**General Cargo Ship** - coal, grains, heavy machinery, cars, electronics, clothing, fruits, oil, LNG, timber, chemicals

**Liquid Bulk Tanker** - chemicals, oil

**Container ship** - coal, grains, cars, electronics, clothing, fruits,

**Liquid Natural Gas (LNG) tanker** - LNG

**Dry Bulk Carrier Ship** - coal, grain, timber, electronics, clothing

**Roll on Roll Off Ship** - cars, heavy machinery

**Cruise Ship** - passengers





# PORTS

## THE ROLE OF PORTS IN THE MARINE INDUSTRY

**GRADE LEVEL: K-5**

**TIME: 20-40 MIN**

### SUMMARY

A port can be defined as a harbor or an area that provides shelter to numerous boats and vessels, and allows for constant or periodic transshipment of goods and/or energy. Ports are a vital part of the marine industry and provide the link between land and the sea. In this lesson, we will review types of ports and what roles they play in the shipping industry and communities.

### OBJECTIVES

Students will:

1. Identify the different types of ports and their functions.
2. Understand the importance of ports.

### STEM APPLICATIONS

Science, Engineering, and Mathematics

### NGSS

**3-5-ETS1-1.** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

**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.

**3-5-ETS1-3.** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

### VOCABULARY

**Port** – a harbor or an area that is able to provide shelter to numerous boats and vessels, and can also allow constant or periodic transshipment of goods and/or energy – a place for loading and unloading cargo.

**Cargo** – goods carried on a ship, aircraft, or motor vehicle.

**Import** – bring (goods or services) into a country from abroad for sale.

**Export** – the selling and sending out of goods or services to other countries.

### MATERIALS

1. "Ports" PowerPoint
2. Computers/tablets

### BACKGROUND

Ports provide areas for ships to dock. The role of each port varies with regard to what is being transported. Ports vary in size; some ports are used strictly for cargo ships or cruise ships, while other smaller marinas are used for pleasure boats. Ports are crucial for the shipping industry because it is where ships can refuel, balance their water tanks, and allow the crew to rest and prepare for an upcoming voyage. Additionally, ports are important





waste facilities for ships since there are strict regulations on waste management at sea to ensure marine protection. Due to its close proximity to sea, ports are an essential link between commerce and marine environment conservation.

Ports not only provide a valuable resource to the marine industry, but to the community in which it resides as they provide opportunities for tourism and jobs. Ports not only serve ships, but they are an excellent place for anyone to go bird watching, kayaking or grabbing a bite to eat.



## ACTIVITY

### 1. Engage/Elicit

Ask students “what is a port?” Their answers will vary. When describing ports, students may think of ports far away from pictures or movies that they have seen. However, there are active ports in many states such as in Connecticut, Florida, and Texas.

Ask students to imagine that they were given money to open their own port. What type of port would they open? Where would it be located? What types of ships would dock there?

### 2. Explore

Go through the “Ports” PowerPoint with students, stopping at each slide to activate the students’ knowledge of ports they have seen. You could even bring students to a local port so they can see first-hand the hustle and bustle of a port!

### 3. Explain

Have students gather around tablets and/or computers and log onto [Gamesgames.com](http://www.gamesgames.com). Go to the game called “Shiploader.” Have students use their knowledge to load the ships in the game. Make sure to make the connections to the ships, the cargo and what type of port they would/could be at. <http://www.games-games.com/game/ship-loader>.

### 4. Evaluate/Wrap-up

Make sure to make the connections to the ships, the cargo and what type of port they would/could be at while students are playing the game.

## DIVE DEEPER

For more activities and information about ships and the marine industry, please visit <http://www.namepa.net/education>.



# HISTORY OF MARINE TRANSIT

A TIMELINE OF THE MARINE TRANSIT INDUSTRY

**GRADE: 6-8**

**TIME: 30-45 MIN**

## SUMMARY

In this lesson students will be given a brief introduction to the history of Marine Transit from the Egyptians to present day.

## OBJECTIVES

Students will:

1. Learn the history of marine transportation.
2. Identify themes that have stood the test of time in the marine industry.

## STEM APPLICATIONS

Science, Technology, and Math

## NGSS

**K-2-ETS1-2.** Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

**K-2-ETS1-3.** Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

## VOCABULARY

**Astrolabe** – an instrument formerly used to make astronomical measurements, typically of the altitudes of celestial bodies, and in navigation for calculating latitude, before the development of the sextant. In its basic form (known from classical times), it consists of a disk with the edge marked in degrees and a pivoted point

## MATERIALS

- History of Maritime Shipping PowerPoint
- Sticks
- Twine
- Water
- Rice, sand, gravel wrapped and tied in plastic wrap
- Paper template for astrolabe from <https://in-the-sky.org/astrolabe/>

## BACKGROUND

Every item or product we use has made a journey from somewhere, usually with materials exported from all different places. Just look at the tags on much of your clothing! While shipping now transports 90% of the manufactured goods, shipping did not start as the large container ships we see today. Shipping started with logs that carried small cargos downriver in ancient civilizations. In this lesson, we will go over a brief history of maritime shipping through the centuries.



## ACTIVITY

Go through the History of Maritime shipping with students. At the end of the PowerPoint there is a video explaining the History of Shipping stop video as necessary to stress points.

### 1. Engage/Elicit

Point out to students that as cargos changed, so did ships that carried those cargos. Cargo has shifted from goods such as food and wood for building to metal, steel, plastics, and other complex materials that are manufactured today. What started as logs eventually turned into the large container ships we see today. It is also important to point out that the Industrial Revolution and several advancements in technology and manufacturing have improved the effectiveness of the shipping industry from ancient times.

### 2. Explore

Students will use their knowledge to create a ship by tying sticks together. They will then “float” their “ships” and add cargo (plastic wrapped sand, gravel, etc.) While students are testing their “log ships,” the other students will be making their own astrolabe following the directions at <https://in-the-sky.org/astrolabe/>.

### 3. Explain/Evaluate/Wrap-up

Students should understand that the shipping containers we see today started as simple logs that helped carry cargo downriver. The development of ships led to an increase in trade. Eventually, modern day shipping was born.

## DIVE DEEPER

For more information visit <https://in-the-sky.org/astrolabe/>. Parts of this lesson were adapted from that website.

For more activities and information about ships and the marine industry, please visit <http://www.namepa.net/education>.



The various parts of a 18th century astrolabe, disassembled made in North Africa.



# CANALS AND WATERWAYS

THE HISTORY OF CANALS AND WATERWAYS AND THEIR IMPORTANCE IN SHIPPING

**GRADE LEVEL: 6-8**

**TIME: 45-60 MIN**

## SUMMARY

This is a history lesson regarding the impact and the role canals have on the marine industry. Students will learn about canals, how they are constructed, how they work, and their economic impact on surrounding areas. Using this information, students will make a model of the Panama Canal as a class.

## OBJECTIVES

Students will:

1. Understand the importance of canals in marine trade and their impact on the surrounding economy.
2. Conceptualize the engineering behind canals.
3. Build a model of the Panama Canal as a class team-building exercise.

## STEM APPLICATIONS

Technology, Engineering, and Math

## NGSS ALIGNMENT:

**K-2-ETS1-2.** Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

**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.

## VOCABULARY

**Atlantic Ocean** – lies between Europe and Africa on the east and North and South America on the west and is divided by the equator into the North Atlantic and the South Atlantic Oceans.

**Canal** – a man-made waterway that allows for the passage of vessels inland.

**Canal Locks** – devices used for lowering or raising vessels between stretches of water of different levels on canal waterways.

**Dredging** – clearing or carving out a path with a dredge by scooping out mud and weeds.

**Gatun Lake** – a large man-made lake which 20 miles of the 48-mile-long Panama Canal passes through.

**Isthmus of Panama** – a narrow strip of the land of Panama with sea on either side, forming a link between two larger areas of land.

**Pacific Ocean** – the largest ocean in the world, the Pacific Ocean separates Asia and Australia on the west from North America and South America on the east.

## MATERIALS

1. Internet access/projector
2. Map of oceans and canals
3. 3 Shoe boxes per group
4. Cardboard
5. Craft glue
6. Tape
7. Empty paper towel rolls
8. Markers
9. Scissors
10. Dowel/straws
11. Small toy boats

## BACKGROUND

Canals have been around since the 6th century BC and were an essential component to society in ancient civilizations. They allowed the Mesopotamian civilization to link and control the waters of the Tigris and Euphrates rivers and the ancient Egyptians to connect the desert lands with the Nile. The first large-scale canal that was used specifically for water transport was spearheaded by Persian Emperor Darius I and linked the Nile River to the Red Sea. This created a perfect terminus for the initial construction of the Suez Canal by the Egyptians in 1854. The current Suez Canal fully connects the Mediterranean Sea to the Red Sea and officially opened for transport in 1869. Shortly thereafter, many different countries and states began to realize the incredible importance of canals as they vastly improved transportation efficiency by reducing costs, voyage distance, and travel time.

Another canal that drastically impacted the shipping industry was the Panama Canal. The French began construction on the canal in 1870 on the Isthmus of Panama. However, the project was only half completed due to financial setbacks and diseases brought on by poor sanitation and mosquitoes. Following this, the United States signed treaties with Great Britain, Colombia, and Panama to rebuild and complete the canal. Building started in 1907 and was completed in 1914 at a cost of nearly \$345 million at the time.

Since completion, the Panama Canal has allowed ships to maneuver across Panama instead of traveling the 12,000 miles around Cape Horn in South America. Each ship must pay a toll to use the canal, which has generated a significant amount of revenue for Panama, a net income of over 1 billion dollars annually according to the Panama Canal Authority. The canal has also been vital to the development of the global economy as it substantially lessened voyage distance and time and thus has allowed the export and import of goods to become less expensive and for goods to reach their destinations more quickly.

Another noteworthy canal is the Erie Canal, the longest artificial waterway and largest public works project in North America after its completion in 1825. The canal runs from Albany to Buffa-

lo, and helped New York to expand its commerce, trade, immigration, and recreational opportunities. The Erie Canal is impressive in that it traverses several environments including rocky cliffs and swamps. In 2000, the U.S Congress established the Erie Canalway National Heritage Corridor, as this canal helped to flow social reform ideas, languages, and religions through the state. The Erie Canal is now managed by the National Park Service to preserve its historical significance.

## ACTIVITY

### 1. Engage/Elicit

Before beginning the activity, recap the history of canals and what they are used for. Go over some of the vocabulary words with your students and talk about how canals are such an important economic factor.

Watch Panama Canal Video

<http://www.history.com/topics/panama-canal/videos/panama-canal-locks>

### 2. Explore

To begin the activity, visit the Panama Canal homepage at: <http://www.pancanal.com/eng/general/howitworks/>

Play the multimedia videos on how Panama Canal works.

Discuss how there are canals and locks all over the world that aid people from getting from one body of water to another. Review the following website for canals around the world:

<http://www.sip.ie/sip070/World%20Canals.html>

There are locks as close to us as New York. Visit the following website to show the canals in New York:

<http://www.canalny.com/canal-sections>

Review and discuss the reasons for canals. Canals have also developed ways to ensure the natural environment is not hindered by the construction of canals. For example, a set of locks in North Carolina managed by the US Army Corps of Engineers has devel-

oped a partnership to construct a fish ladder next to the set of locks and dams. This fish ladder allows anadromous, or fish that migrate upriver from salt water to spawn, a way to cross the locks and reproduce while also ensuring boats and cargo can make it up and down the Cape Fear River. Read more here: <http://portal.ncdenr.org/web/mf/cf-120512-cape-fear-river>

Some possible questions to ask students might be:

- What is a canal and how does it work?
- Why are canals important to the global economy?
- What benefits do canals give to the country that owns it?
- What might happen if canals were not invented?

### 3. Explain

Once they understand what the canal looks like and how it works, students will break into groups of no more than 4 and use the materials to design their own lock. Students must make sure they design how the water will enter and exit the lock and how a boat will pass through the canal.

### 4. Evaluate/Wrap-up

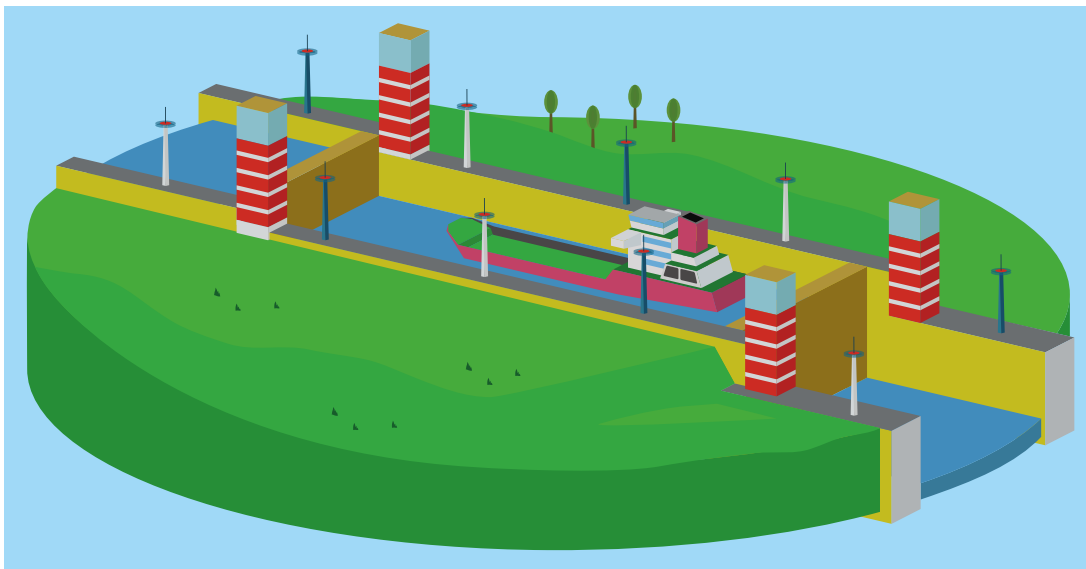
Students will then present their design to the class explaining why they chose the setup that they did and how well it works.

## DIVE DEEPER

For more information, visit the Panama Canal Website at: <http://pancanal.com/>.

Local to the New York area? You can visit the Erie Canal, as it is preserved by the National Park Service. For more information, visit <https://eriecanalway.org/learn/history-culture>. Or, check out this video on the building of the historical Erie Canal: <https://www.history.com/shows/america-the-story-of-us/videos/building-the-erie-canal>.

For more activities and information about the marine industry, please visit: <http://www.namepa.net/education>.





# SHIPPING AND ITS ROLE IN GLOBAL SOCIETY

## HOW A SHIP TRANSPORTS CARGO TO ITS DESTINATION

**GRADE LEVEL: 6-8**

**TIME: 30-45 MIN**

### SUMMARY

In this lesson, students will experience all the steps that it takes to ship cargo from one place to another. They will simulate trading goods between countries and discover how many different roles are necessary to ensure the proper procedures are followed in the shipping industry. They will explore the roles of the producer of goods, the consumer of goods, the shippers, and the charterers in between.

### OBJECTIVES

Students will:

1. Discover the differences in the roles of producer, consumer, ship charterer, ship owner, and shipbroker in the marine industry by role-playing scenarios.
2. Conceptualize how goods are tracked while being shipped to ensure that the goods arrive safely and on time.
3. Explore different career opportunities in the shipping industry.

### STEM APPLICATIONS

Technology and Mathematics

### NGSS ALIGNMENT:

**3-5-ETS1-1.** Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

**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.

### VOCABULARY

**Chartering** – the act of “renting” a ship from a vessel owner to ship goods.

**Commodity value** – the price the good will fetch in the market at optimal use conditions.

**Charter party** – the contract between the ship-owner and the charterer for the use of the vessel. There are many different types of charter parties that all have different durations and agreements.

**Freight** – goods transported by truck, train, ship or aircraft.

**Ship owner** – a person or company who owns a ship and allows it to be chartered to ship goods from one point to another.

**Charterer** – the person or company who rents the ship from the ship owner. In most cases the charterer is the person who owns the goods that need to be shipped. The charterer is often a producer who ships goods to the consumer but sometimes the charterer is a consumer who prefers to load from the producer’s port of origin and ship the goods themselves.

**Shipbroker** – acts as mediator between the ship owner and the charterer of the goods to be shipped. A shipbroker may help a charterer find the most suitable ship for their cargo or help an owner find the most suitable cargo for their ship.

**Bill of lading** – the legal documentation between the cargo owner and ship owner that details the type, amount, and destination of the cargo. This document also serves as a receipt of shipment when the goods have finally reached their specified destination.

### MATERIALS

1. Paper
2. Pencils
3. Calculator
4. Simulation work sheet handout
5. Computer access

### BACKGROUND

Since resources around the world are not evenly distributed, countries rely on one another to trade for the goods they need. Producers of these resources need to ship them to consumers who can sometimes be thousands of miles away. For example, coffee is one of the most consumed beverages in the United States with a retail value of over \$5 billion. Most of this coffee is imported from Brazil, Vietnam, and Columbia by means of shipping.

Shipping is the most efficient way to transport goods to where they need to be at the cheapest price. Producers or consumers of these goods may hire a broker to help find a ship to transport their products under the terms of what is called a charter party. There are many different types based on the distance the ship is going, days it is going to be out at sea, type and amount of cargo on board. All of the cargo is tracked and recorded by the bill of lading. It is a charterer and shipbroker’s job to find the supplier of the cheapest and most efficient way to ship the resources to their consumer.

## ACTIVITY

### 1. Engage/Elicit

To begin the lesson, start by defining the vocabulary with your students and discuss what they think the role of each would be in the shipping industry. For a larger group, this could be done by creating a matching puzzle. Each student will receive a card with a definition or a vocabulary word, cut the pieces of paper to match with the respective term. Allow the students to find their match amongst the room.

The marine industry is not all about shipping out to sea; it has a lot of opportunities shore-side that many students do not realize! Once they have done some independent research on each term, break up the students into groups of four so that each group contains the following roles: the charterer (producer of goods), the consumer, the shipbroker, and the ship owner.

### 2. Explore

Show students the following video, <https://www.youtube.com/watch?v=IDmLEFDDd-c> to make connections with the vocabulary terms.

Have each student pick a simulation card and attempt to go through the process of how goods are transported from one place to another.

Students should rotate through roles every time they finish

the simulation so they all get a chance to experience making decisions!

Ask students to create a skit based on the different roles in the shipping industry and how they relate to one another.

Ask students to imagine that they were given 1 million dollars to start their own shipping business. What and how would they ship? What would they spend their money on?

### 3. Explain

During the simulation, go around and ask students what the decisions of each role have on the effect of the overall cost of the journey. For example, discuss insurance.

### 4. Evaluate/Wrap-up

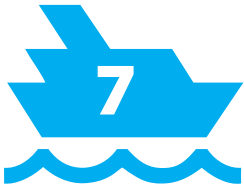
To finish this activity, have the groups present on the different scenarios. Ask them what the hardest part of the activity was or what the hardest decision-making role was.

## DIVE DEEPER

If you have students who are really interested in learning more about these types of careers, direct them to <http://www.ics.org.uk> to see how they can learn more about the shipbroking industry.[need more than this]

For more activities and information about the marine industry, please visit <http://www.namepa.net/education>.





# NAUTICAL CHARTS AND GPS

THE IMPORTANCE OF NAVIGATIONAL TOOLS IN THE MARINE INDUSTRY

**GRADE LEVEL: 9-12**

**TIME: 45-60 MIN**

## SUMMARY

This is an introductory lesson to the importance of navigation in the marine industry. It will cover the use of nautical charts, chart symbols, and the importance and uses of Global Positioning System (GPS). Students will be able to identify basic symbols on nautical charts. A lesson extension is possible if GPS receivers are available for learning use. Using these, students can engage in a GPS scavenger hunt and navigate an area outdoors!

## OBJECTIVES

Students will:

- Understand the importance of nautical charts and how they play a significant role in the movement of ships.
- Recognize basic nautical chart symbols and identify their meaning relating to the “rules of the road.”
- Understand what GPS is, how it works, and its role in the marine industry.
- Experiment with GPS units and coordinates.

## STEM APPLICATIONS

Technology and Math

## NGSS ALIGNMENT:

**PS3.A:** Definitions of Energy: Energy, in the form of radio or sound waves, depends on the motion and interactions of the matter and radiation within the system it is passing through. Students will learn about radio waves as forms of mechanical energy and how they travel.

**PS4.A:** Waves and their applications in technologies for information transfer: The wavelength and frequency of a wave are related to one another by the speed of travel of the wave and the medium through which it is passing. Students will learn that they correlate to how GPS radio signals travel.

**PS4.C:** Multiple technologies, based on the understanding of waves and their interactions with matter, are a part of everyday experiences in the modern world. Students will apply this concept in their explanation of how GPS satellites communicate and how this affects end usability in everyday life.

**ETS1.A** Engineering Design: Students will be able to demonstrate the design criteria required for GPS units to function and the constraints on successful GPS signals and accuracy.

**ETS2.B** Links Among Engineering, Technology, Science and Society: Using knowledge of the technology of GPS, students should be able to correlate how widespread adoption of this technology affects society and the environment, especially in regards to changing climate.

## VOCABULARY

**Aid to navigation** – any landmark or man-made structure that helps the pilot or captain to navigate the water; including buoys, lighthouses, fog signals, or day beacons.

**Electronic Chart Display and Information System (ECDIS)** – electronic version of a nautical chart commonly found in modern day ships.

**Global Positioning System (GPS)** – a network of at least 24 operational satellites that orbit the Earth and send signals to GPS receivers in order to determine the receiver’s location, speed, and direction travelling (heading) anywhere in the world.

**Latitude** – imaginary lines that are drawn on maps to help locate the precise coordinates of objects. Latitude runs as circles parallel to the equator and measures the distance between the equator (0 degrees) to the North and South poles (90 degrees south or north).

**Longitude** – imaginary lines that are drawn on maps to help locate the precise coordinates of objects. Longitude measures from east-west and are known as “meridians.” The prime meridian (0 degrees) is located in Greenwich, England. Locations east to the prime meridian are labeled as degrees east while locations west to it are labeled as degrees west.

**Nautical charts** – tool mariners use in order to maneuver safely around harbors, shores, and the open ocean. They depict the dangers to navigation, buoy locations, and water depths of a specified area. They are often electronic.

## MATERIALS

- “Navy Nautical Chart” video <https://www.youtube.com/watch?v=bL4jWde4GQI>
- “GPS” video <https://www.youtube.com/watch?v=4WMXW3o-paw>
- Papers and pencil for each student to answer questions and take notes
- “Nautical Symbols” cheat sheets
- 6-7 hand-held GPS trackers (if available for optional extension)
- “GPS Scavenger Hunt” sheet (if doing extension; under hand-outs)

## BACKGROUND

While ships have been around for thousands of years, maneuvering them safely on the water is still a challenge to this day. Nautical charts have been a crucial tool to guide ships for mariners of all types, whether they are recreational boaters, large tanker captains, or pilots in harbors. Charts are paper or electronic representations of an area that indicate land, water depth, shipping lanes, dangers, and guides to navigation. They assist the navigator in arriving to their destination in a particular area safely and easily. The phrase “chart your course” references



plotting a designated course upon a nautical chart so the captain knows where he/she is guiding the vessel. Charts were originally drawn on sheepskin, but have been printed on paper for many generations. Most modern ships have electronic charts that make navigation much easier. This is called Electronic Chart Display and Information System (ECDIS).

ECDIS works in conjunction with the Global Positional System (GPS) to track ships and update their surroundings onboard. GPS was declared fully operational in 1995 by the United States Department of Defense. Today, there are thirty-two fully operational satellites that make up the GPS network. GPS works so efficiently because it utilizes satellite triangulation to pinpoint the ship's location, speed, and direction any time of the day in any weather. When a GPS receiver sends out a microwave signal, three of the closest satellites pick up the signal and bounce the signal back to it, giving the receiver's location on Earth based on longitude and latitude. A fourth satellite is used to confirm the coordinates to ensure an accurate and precise reading.

GPS systems have drastically changed the way the world operates, especially as it pertains to the marine industry. It has increased the safety, efficiency, and speed of shipping. GPS is not only used for positioning, but it is also used for underwater surveying as well. This has helped us to develop our understanding of the oceans we are sailing upon.



## ACTIVITY

### 1. Engage/Elicit

To start this lesson, begin to engage your students by having them answer the following questions on a piece of paper:

- What are nautical charts?
- What are they used for and who uses them?
- What does GPS stand for?
- How does GPS work and what does it tell us?

Have each student pass in their responses and compare their answers after the lesson by having them answer the same questions again.

### 2. Explore

Show the "Nautical Charts" video <https://www.youtube.com/watch?v=bL4jWde4GQI>

Show the "GPS" video <https://www.youtube.com/watch?v=4W-MXW3opaw0>

### 3. Explain

After the presentation, showing both videos, have the students compare and contrast nautical charts to GPS. This could be done by allowing the students to perform skits to highlight the differences. What are the advantages of each? Disadvantages? Which do they personally provide and why? What might happen if GPS did not work? How would mariners and navigators know how to get to where they need to be? They would have to rely entirely on paper charts and continuously update them to account for changing environments and new dangers.

Ask students to create a chart or paper map to go from their house to the grocery store, park, or another spot in town. Or, ask students to create a chart for another student to find a certain spot in the school. What would they add to the map? What information would be helpful for somebody reading?

Ask students to locate certain points on a paper map by giving them latitude and longitude. This will help students conceptualize the differences and how it aids in navigation. Add squares to the paper map. Label the middle line zero degrees. Each line to the left of zero, count downwards by tens (10, 20, -30...) and add W for west. Do the same towards the right but count upwards (10, 20, 30...) and add E for east. Going up and down, find the middle line and label that zero as well. Going upwards, count up by tens (10, 20, 30...) and add N for north. Going down, count downwards by tens (10, 20, 30...) and add S for south. Have the students label a point on the chart where two lines intersect and label it with a number with E/W first followed by a number with N/S.

## EXTENSION

If you have access to GPS receivers and time allows, playing a GPS scavenger hunt is a great way to give your students real-world experience utilizing GPS outside of the classroom! Pre-planning is required, as it involves exploring the outside area around your school/teaching facility and picking objects coordinates to use for the scavenger hunt. Having an aid or assistant to keep an eye on the students while they are outside is also recommended.

To prepare:

- Ensure you have access to a large, easy-to-supervise area for the students to explore and discover objects based on latitude and longitudes coordinates and a description of the object they are to find in the area.
- Pick the coordinates of easy-to-identify objects to use in the hunt (i.e. a large rock, a statue, a tree, etc.).
- Record the objects' latitude and longitude coordinates using your own GPS receiver.
- Create a profile of each object for the students to identify (example: the object is a tree – "I am tall with deep roots and I breathe too.")
- Record all of the coordinates and profiles for each object and print out the information to pass out to each group of students.

Once the students have broken up into groups (small groups of 2-3 are preferred, but it depends on how many GPS receivers you have available) and each have their own GPS receiver, briefly show them how to read the latitude and longitude coordinates on the GPS. Once they are all ready, head outside and begin the scavenger hunt! Make sure to keep supervision of the groups as they are outside.

## 4. Evaluate/Wrap-up

If you were able to do the extension, have the students pass in their scavenger hunt papers to grade. Go over the nautical symbols matching sheets to discover how well they did! Now have them answer the questions you asked them in the beginning of the lesson again and pass back their answers to compare. Do they understand the importance of nautical charts and GPS better than they did before? If they did the GPS scavenger hunt, have them discuss the hardest part about the activity and why. What did they like most?

## DIVE DEEPER

Want your students to gain more experience with or learn more chart symbols? Are they curious to see other nautical charts? Visit the Office of Coast Survey through the National Oceanic and Atmospheric Administration at [www.nauticalcharts.noaa.gov](http://www.nauticalcharts.noaa.gov) to explore their publications and view their "U.S. Chart No. 1: Symbols, Abbreviations and Terms used on Paper and Electronic Navigational Charts" PDF download!

Show students the geocaching.com website. This website is a real-life GPS treasure hunt, with various geocaches hidden throughout the world. It is free to sign up, and students can search for geocaches from their smart phone. It is a really cool way to engage in geospatial technologies and get outside!

GIS (Geographic Information Systems) is an example of how nautical charts have combined with GPS. These online maps incorporate various data layers to solve environmental problems. Search for GIS maps that pertain to your state or community and explore!

For more activities and information about the marine industry, please visit <http://www.namepa.net/education>.





# MARITIME REGULATIONS

THE REGULATIONS THAT SAFEGUARD OUR WATERS

**GRADE LEVEL: 9-12**

**TIME: 30-40 MIN**

## SUMMARY

This lesson is focused maritime on regulations. The shipping industry is principally regulated by the International Maritime Organization (IMO), which is the United Nations agency responsible for the safety of life at sea and the protection of the marine environment. MARPOL is a set of regulations that are designed to prevent pollution of the marine environment by ships. MARPOL has 6 Annexes that cover different types of pollution. For the purposes of this lesson we will focus on Annexes I, II, IV, V, & VI. Students will learn and understand each annex.

## OBJECTIVES

Students will:

- Understand MARPOL and its mission.
- Identify and describe Annex's I, II, IV, V, & VI.
- Engage in discussion about why these regulations are necessary.

## STEM APPLICATIONS

Science and Mathematics

## NGSS ALIGNMENT:

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

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.

## VOCABULARY

International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL) – the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes, such as from oil spills, hazardous materials, chemicals, garbage, sewage, and atmospheric emissions.

## MATERIALS

- “MARPOL Annex” PowerPoint
- Glass jar
- Distilled water
- Oil
- Blue food coloring
- Rubber bath tub toys (fish, whales, marine life)

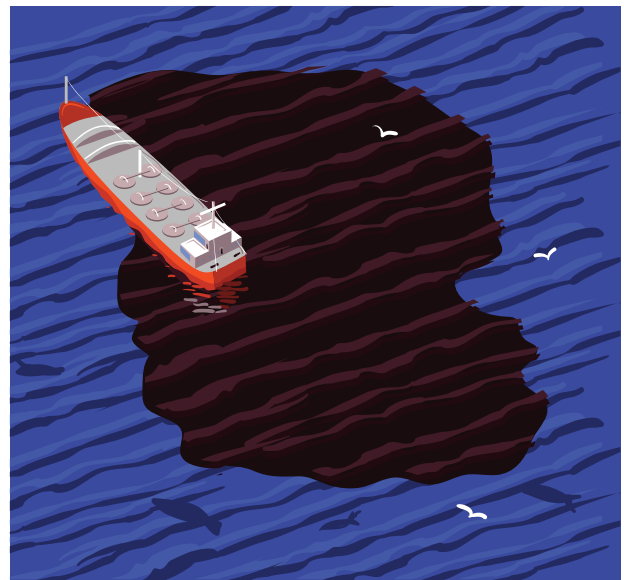
## BACKGROUND

Oceans, lakes, and rivers are the cradle of life on our planet. Without them, no life on earth would exist. Unfortunately, the world's oceans, lakes, and rivers have been seriously endangered by the actions of humans. Marine pollution comes in many forms such as oil, noxious liquids substances, sewage, debris (plastic items – bags, bottles, utensils, straws, cardboard, glass bottles, metals, wood and more) and air pollution. While some environmental controls and regulations have been implemented, they have generally been inadequate in protecting marine environments.

Pollution control is a multi-faceted issue which impacts humans, plants, and animals alike. It is very difficult to implement strict pollution control laws across the vast ocean. Plastics in the ocean continue to endanger marine food webs, the release of harmful chemicals into the atmosphere continue to accelerate climate change, and the release of oil into waters continue to harm wildlife. For these reasons, new and special efforts are needed to remove these threats and Save Our Seas.

To assist in these efforts, MARPOL (International Convention for Prevention of Pollution from Ships) was developed and implemented. MARPOL is an agreement, or convention, written by the members of the International Maritime Organization (IMO) to control pollution from ships. In the PowerPoint, you can learn more about MARPOL Regulations and how we can prevent marine pollution and Save Our Seas. Each annex covers a different type of pollution.

Note: The regulations are written. Do not read the slides as much as have them generate discussion about the problem.



## ACTIVITY

### Oil Pollution Activity

Fill jar with distilled water and add blue food coloring. Mix food coloring and water until well blended. Make sure to point out to students how easily the water and food coloring mix. Then add the oil. Point out how the oil and water do not mix and the oil “floats” on the water. The oil does not mix well with the water because the water molecules are attracted to each other more than they are to the molecule of the oil. No matter how much you stir water and oil will not mix. Make a connection to how oil would look on the ocean. Add the bathtub toys avoiding the oil. Mix the water to imitate waves.

What happens to the bath tub toys? The oil easily covers the toys, especially when you mixed the water. Imagine what would happen in a real ocean with real waves and real animals. The animals are almost instantly covered with the oil, which causes great harm.

### ENGAGE/ELICIT:

Large oil spills have been mitigated to a great extent with newer regulations in the shipping industry. Oil spill clean ups are costly

and it takes a long time for all of the oil to be removed from the ocean.

Many of the most harmful spills/leaks are due to human error or carelessness. These occurrences are toxic to marine life and can cause widespread damage to shorelines and beyond. The MARPOL Annexes are one way to help prevent these disasters.

People, like you and me, need to take responsibility and take action to be sure we prevent further pollution to the marine environment.

### DIVE DEEPER

Show students the following video that highlights how oil spills are cleaned by professionals: <https://www.youtube.com/watch?v=3DbSIaG3F3A>.

For a more detailed description of the International Maritime Organization (IMO) and their role in maritime policy, see page 27 - The Regulation of the International Shipping Industry: A Comprehensive Background.

For more activities and information about the marine industry and a NGSS-aligned Educator’s Guide to Marine Debris, please visit <http://www.namepa.net/education>.





# CAREERS IN THE MARITIME INDUSTRY

## CAREER PATHS IN THE MARINE INDUSTRY

**GRADE LEVEL: 8-12**

**TIME: 30-45 MIN**

### SUMMARY

In this lesson, students will be introduced to the different careers that are part of the maritime industry. Students will learn that these careers are on sea, at ports, off shore, and in corporate settings.

### OBJECTIVES

Students will:

1. Identify the different careers in the maritime industry.
2. Understand what academic institutions offer programs that lead to careers in this industry.

### STEM APPLICATIONS

Science, Engineering, and Mathematics

### VOCABULARY

**Boatswain** – a ship's officer in charge of equipment and the crew.

**Brokerages** – an intermediary who helps match ship owners with charterers and writes up the charter party.

**Chartering manager** – a person who calculates freight rates and either buys or sells the shipping service.

**Longshoremen** – a person employed in a port to load and unload ships.

**Mate** – a deck officer of a merchant ship underneath a master.

**Operations manager** – coordinates with the charterers and the ship where to load and discharge and where to fuel the ship.

**Seaman** – a person who works as a sailor, especially one below the rank of officer.

**Steward** – a person who looks after the passengers on a ship, aircraft, or train and brings them meals.

### MATERIALS

- "Careers in Maritime Industry" PowerPoint
- Paper
- Pencils/pen
- Whiteboard

### BACKGROUND

When people think of careers in the maritime industry, most automatically think of a life at sea. However, the industry has a vast number of careers that range from the sea to the ports to corporate jobs. Any aspect of the maritime industry requires both at-sea and on-land components to complete a successful voyage. Aside from sailors, mates, and captains, there are maritime lawyers, educators, doctors, and military personnel. The maritime industry also heavily relies on marine science and environmental conservation, which offers a wide variety of employment opportunities.

### ACTIVITY

#### 1. Engage/Elicit

Walk through the "Careers in the Maritime Industry" PowerPoint with students. Encourage discussion of those who may want to go into the industry and what interests them.

Ask students to draft a plan of action or flowchart to get to their desired career. Will they attend college? If so, where? What major will they study? Will they try to get at-sea experience elsewhere? How can they gain experience to put on a resume before applying to jobs?

Create a word tree or idea pool for careers in the maritime industry to show how they connect. For a word tree, start with "maritime industry" in the middle and ask students for careers or keywords that can branch from that. Facilitate this discussion as needed.

Ask students to draft an email that they would send to a potential employer. How would they market themselves? What interest do they have about a maritime career? What related experiences would they highlight?

#### 2. Explore

Watch following videos with group. Preview videos so that you can tailor the presentations to the interests of the group.

<https://www.youtube.com/watch?v=XHTG80578p4&t=151s>

<https://www.youtube.com/watch?v=tlon2JulqPU>

<https://www.youtube.com/watch?v=dvyXw4Catj4>

<https://www.youtube.com/watch?v=fbEb2s634Es>

#### 3. Explain

Explain to students that if this is a desired career path for them they should look into offerings in their local community or by starting a NAMEPA chapter.

#### 4. Evaluate/Wrap-up

Draft a list of possible career paths and contacts for students to use.

### DIVE DEEPER

There are many websites that provide resources and job postings for careers in the maritime industry, such as: <http://www.sname.org/educationoptions/careersinthemaritimeindustry>, <https://www.marineinsight.com/careers-2/50-marine-careers-essential-guide/>, and <http://www.mapyourcareer.org/maritime/maritime-careers.html>.

For more activities and information about careers in the marine industry, please visit <http://www.namepa.net/education>



# ADOPT A SHIP:

CONNECTING YOUR CLASSROOM TO THE MARINE INDUSTRY

## What is it?

The “Adopt A Ship” program is a free, useful, sustainable, enjoyable and well-developed “tool” that can help begin the process of increasing students’ awareness of seafarers, shipping and the maritime community, and the critical importance they play in the quality of life for almost everyone on the planet. This program allows students to connect with the marine industry while learning geography, culture, marine operations, and communication skills beyond the words in a textbook. By promoting awareness of the maritime industry in youth, this program can encourage students to pursue a maritime career.

The “Adopt a Ship” Program was initiated by the Cyprus Shipping Chamber, (CSC), and the Cyprus Maritime Environmental Protection Association, (CYMEPA), in 2006 to bring together the Elementary Schools and Seafarers on board ships operated by CSC Members. The program expanded into the Philippines, Poland, India and Greece in 2017. More than 70 ships now participate in the Cyprus program. More than 30 ships are participating in the Poland program. More than 4,500 children participated in Manila in 2018. To learn more about the program and download a program flyer, please visit <http://csc-cy.org/adopt-a-ship-programme/> or connect on Facebook: “Adopt A Ship International.”

## How does it work?

Versions of the Adopt A Ship program vary from country to country. The basic program consists of:

1. A senior officer (usually the Captain) onboard a ship exchanging a short email message with a school classroom or an orphanage/shelter/hostel once a week. This communication focuses on life on board, cargo, trade patterns, geography, weather, and more.
2. The children are given a 4 x 6 foot world map with sea lanes that they use to track the movement of that ship.

Schools have the option to expand upon this basic program by implementing tests, scheduling in-person visits with the seafarers and captains either in school or at a designated industry site (where possible near a major port), utilizing Skype for video calling, and awarding certificates upon completion of the program.

For more information on how to get your school or organization involved, please contact Nina Quaratella at [n.quaratella@namepa.net](mailto:n.quaratella@namepa.net).





# AN OVERVIEW OF REGULATIONS RELATING TO THE INTERNATIONAL SHIPPING INDUSTRY

**THE FIRST KNOWN FLOATING VESSELS** date back to 10,000 BC. These were much more basic craft than the vessels we think of today. The Egyptians started designing ships for trade and transport around 3,000 BC, and maritime law was needed. Maritime law, sometimes called Admiralty law, is a distinct body of law that regulates commerce and navigation on the seas and navigable waters. The first known reference to maritime law dates all the way back to the 8th century BC in the Code of Hammurabi. Over the years, maritime law has developed about as much as those first rudimentary floating vessels of 10,000 BC have evolved into giant container ships more than three football fields in length today.

Today, much of the maritime industry is regulated by the International Maritime Organization (IMO), a specialized body of the United Nations tasked with the safety and security of shipping and the prevention of marine pollution by ships. Consisting of 171 Member States, three Associate Members as well as numerous non-governmental organizations (NGOs) and inter-governmental organization (IGOs) holding consultative status, the IMO works to achieve its mandate by developing and maintaining a comprehensive regulatory framework for worldwide shipping. The IMO has approximately 60 legal instruments under its purview, ranging from the Safety of Life at Sea Convention (SOLAS), 1974, as amended, International Convention for the Prevention of Pollution from Ships (MARPOL), 1973, as modified by the Protocol of 1978 relating thereto and by the Protocol of 1997, the International Convention on Salvage (SALVAGE), 1989, and the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, (STCW), among many others.

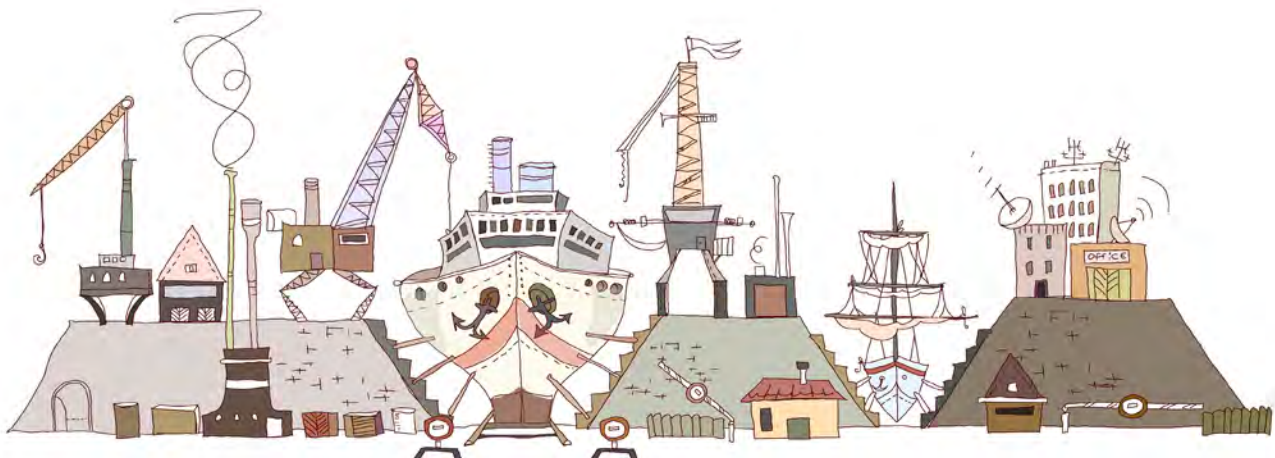
Of the approximately 60 treaty instruments of the IMO, 21 are directly environment-related. The Marine Enforcement Division, under the purview of the MEPC, is the IMO's senior technical body on marine pollution-related matters, referred to as MARPOL (a contraction of MARine POLLution). Along with MARPOL, the Division oversees the Ballast Water Management Convention (designed to prevent against the spread of harmful aquatic organisms carried in ships' ballast water), the Hong Kong Con-

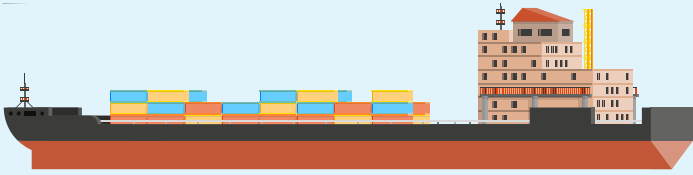
vention (aiming to ensure the safe and environmentally sound recycling of ships) and Convention on the Prevention of Marine Pollution by Dumping and Wastes and Other Matter (more commonly known as the London Convention) and its subsequent protocol, the London Protocol.

The IMO also designates vulnerable areas in need of special protection due to their ecological, socio-economic value or due to scientific reasons as Particularly Sensitive Sea Areas (PSSAs). Examples of areas that have been designated as PSSAs include The Great Barrier Reef of Australia, the Galapagos Islands of Ecuador, and the Papahānaumokuākea Marine National Monument of the United States.

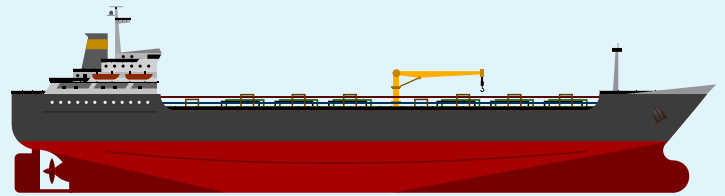
As you can see, there are many regulations governing the behavior of those engaged in commerce on the seas. These regulations are designed to ensure that shipping remains a safe and efficient means of moving cargo between ports. While the IMO is the main regulatory body, IMO conventions must be accepted and implemented by Member States for them to have effect. Member States of the IMO may also implement additional and/or more stringent requirements than those of the IMO. Uniformity, however, is very important in maritime law. As ships move cargo around the world, those operating the ship and those who have interest in the cargo, want to be assured that they are not violating any regulations no matter whose waters they are transiting through.

Complying with regulations generally keep those working on-board vessels very busy. For example, mates stand watch on the bridge steering the ship and ensuring the ship is going the correct speed through a PSSA or check the expiration dates on fire extinguishers to ensure that they are in proper working order and any fire would be quickly prevented from becoming a larger incident. Just as important to the maritime industry are those that work on the land-side whether it be at ports, ensuring ships reach their berth safely, the cargo is unloaded/loaded safely and the ships quickly continue on their journey; those involved in the financing, chartering and the crewing of vessels; and the certification societies that ensure ships are seaworthy (reasonably fit) for their intended voyage.

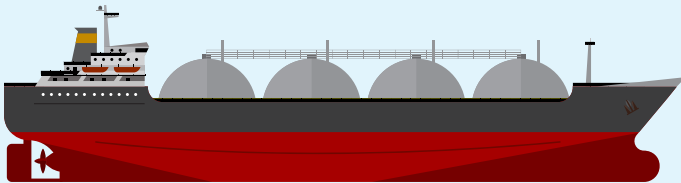




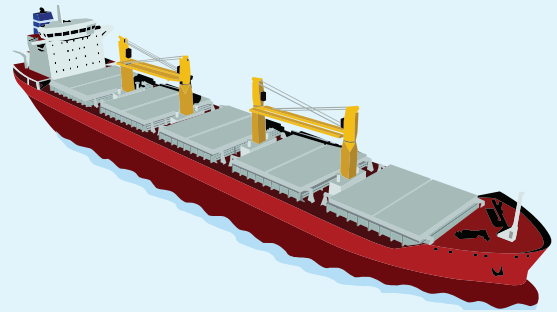
**GENERAL CARGO SHIP**



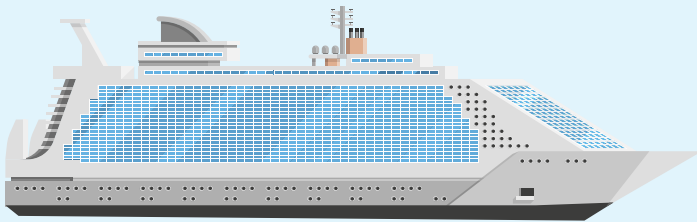
**LIQUID BULK TANKER**



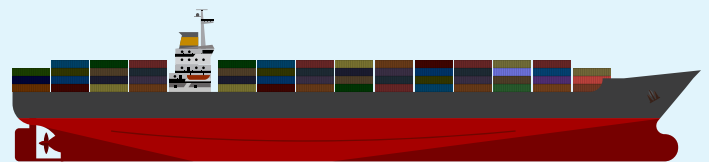
**LIQUEFIED NATURAL GAS (LNG) TANKER**



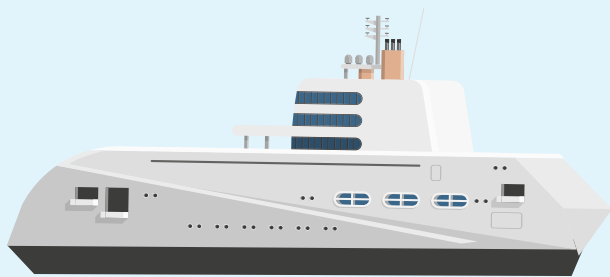
**DRY BULK CARRIER SHIP**



**CRUISE SHIP**



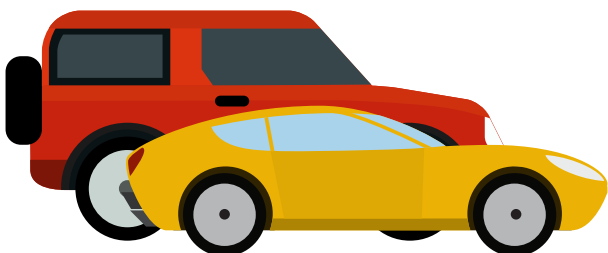
**CONTAINER SHIP**



**ROLL-ON ROLL-OFF (RORO) SHIP**



**TIMBER**



**CARS**

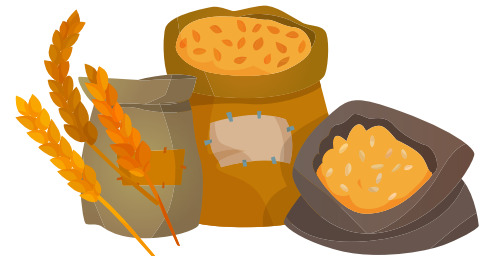


**LIQUID CHEMICALS**





**CLOTHING**



**GRAINS**



**LIQUEFIED NATURAL GAS (LNG)**



**COAL**



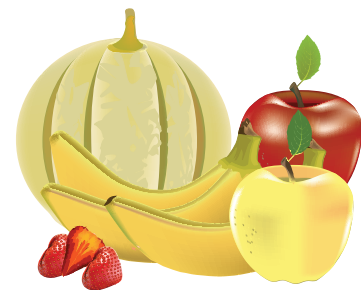
**ELECTRONICS**



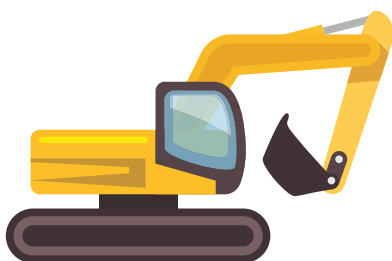
**OIL**



**PASSENGERS**



**FRUITS**



**HEAVY MACHINERY**



**IRON ORE**

# GLOSSARY

**Aid to navigation** – any landmark or man-made structure that helps the pilot or captain to navigate the water; including buoys, lighthouses, fog signals, or day beacons.

**Anchor** – large hook attached to the ship which is cast overboard and digs into the sea bed to keep the ship from moving.

**Astrolabe** – an instrument formerly used to make astronomical measurements, typically of the altitudes of celestial bodies, and in navigation for calculating latitude, before the development of the sextant. In its basic form (known from classical times), it consists of a disk with the edge marked in degrees and a pivoted point.

**Atlantic Ocean** – lies between Europe and Africa on the east and North and South America on the west and is divided by the equator into the North Atlantic and the South Atlantic Oceans.

**Bill of lading** – the legal documentation between the cargo owner and ship owner that details the type, amount, and destination of the cargo. This document also serves as a receipt of shipment when the goods have finally reached their specified destination.

**Boatswain** – a ship's officer in charge of equipment and the crew.

**Bow** – the front of the vessel.

**Bowsprit** – spar attached at an angle to the bow of a ship, used to hold jibs.

**Brokerages** – an intermediary who helps match ship owners with charterers and writes up the charter party.

**Bulk** – goods carried in large amounts.

**Buoyancy** – the ability of an object to float in a liquid.

**Canal** – a man-made waterway that allows for the passage of vessels inland.

**Canal Locks** – devices used for lowering or raising vessels between stretches of water of different levels on canal waterways.

**Cargo** – goods carried on a ship.

**Chartering manager** – a person who calculates freight rates and either buys or sells the shipping service.

**Charterer** – the person or company who rents the ship from the ship owner. In most cases the charterer is the person who owns the goods that need to be shipped. The charterer is often a producer who ships goods to the consumer but sometimes the charterer is a consumer who prefers to load from the producer's port of origin and ship the goods themselves.

**Chartering** – the act of "renting" a ship from a vessel owner to ship goods.

**Charter party** – the contract between the ship-owner and the charterer for the use of the vessel. There are many different types of charter parties that all have different durations and agreements.

**Commodity value** – the price the good will fetch in the market at optimal use conditions.

**Dredging** – clearing or carving out a path with a dredge by scooping out mud and weeds.

**Economy** – the wealth and resources of a country or region.

**Electronic Chart Display and Information System (ECDIS)** – electronic version of a nautical chart commonly found in modern day boats.

**Export** – to carry goods to another country for sale.

**Fore and aft** – from the bow to the stern; fore is towards the front; aft is towards the back.

**Freight** – goods transported by truck, train, ship or aircraft.

**Gatun Lake** – a large man-made lake which 20 miles of the 48-mile-long Panama Canal passes through.

**Global Positioning System (GPS)** – a network of at least 24 operational satellites that orbit the Earth and send signals to GPS receivers in order to determine the receiver's location, speed, and direction travelling (heading) anywhere in the world.

**Hull** – the main body of the boat.

**Import** – to carry goods from another country for sale.

**International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL)** – the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes, such as from oil spills, hazardous materials, chemicals, garbage, sewage, and atmospheric emissions.

**Isthmus of Panama** – a narrow strip of the land of Panama with sea on either side, forming a link between two larger areas of land.

**Keel** – the timber at the very bottom of the hull that runs from the bow to the stern; often called the ships "backbone."

**Latitude** – imaginary lines that are drawn on maps to help locate the precise coordinates of objects. Latitude runs as circles parallel to the equator and measures the distance between the equator (0 degrees) to the North and South poles (90 degrees south or north).

**Line** – a sailor's word for a rope.

**Longitude** – imaginary lines that are drawn on maps to help locate the precise coordinates of objects. Longitude measures from east-west and are known as "meridians." The prime meridian (0 degrees) is located in Greenwich, England. Locations east to the prime meridian are labeled as degrees east while locations west to it are labeled as degrees west.

**Longshoremen** – a person employed in a port to load and unload ships.

**Mast** – a large wooden spar used to hold up other spars and rigging.

**Nautical charts** – tool mariners use in order to maneuver safely around harbors, shores, and the open ocean. They depict the dangers to navigation, buoy locations, and water depths of a specified area.

**Mate** – a deck officer of a merchant ship underneath a master.

**Operations manager** – coordinates with the charterers and the ship where to load and discharge and where to fuel the ship.

**Pacific Ocean** – the largest ocean in the world, the Pacific Ocean separates Asia and Australia on the west from North America and South America on the east.

**Port** – the left side of the ship when facing the bow.

**Port** – a harbor or an area that is able to provide shelter to numerous boats and vessels, and can also allow constant or periodic transaction of shipment – a place for loading and unloading cargo.

**Rigging** – the lines that support the masts and move the sails.

**Rudder** – a blade attached under the stern used for steering.

#### Sails – types of:

**Jibs** – triangular sails at the front of the ship; attached to the bowsprit.

**Square sails** – rectangular sails that are placed square or perpendicular to the keel.

**Main sails** – the lowest sails.

**Top sails** – the next level of sails above the main sails.

**Topgallant** – (pronounced t'gallant) the third sail or set of sails from the bottom, above the topsail.

**Royal sails** – the sails at the very top of the masts.

**Seaman** – a person who works as a sailor, especially one below the rank of officer.

**Shipbroker** – acts as mediator between the ship owner and the charterer of the goods to be shipped. A shipbroker may help a charterer find the most suitable ship for their cargo or help an owner find the most suitable cargo for their ship.

**Ship owner** – a person or company who owns a ship and allows it to be chartered to ship goods from one point to another.

**Spanker** – the biggest sail at the stern of the ship.

**Shrouds** – heavy lines which hold up the masts from the sides of the vessel.

**Starboard** – the right side of the vessel when facing the bow.

**Stern** – the back of the ship.

**Steward** – a person who looks after the passengers on a ship, aircraft, or train and brings them meals.

**Spar** – long pieces of wood used to support the sails and rigging. The bowsprit, masts, and yards are all spars.

**Trade** – the action of buying and selling goods and services.

**Vessel** – a large ship with a hollow container used to carry a cargo or liquid.

**Yards** – horizontal spars that hold square sails





North American Marine Environment Protection Association



## MARINE INDUSTRY LEARNING GUIDE



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