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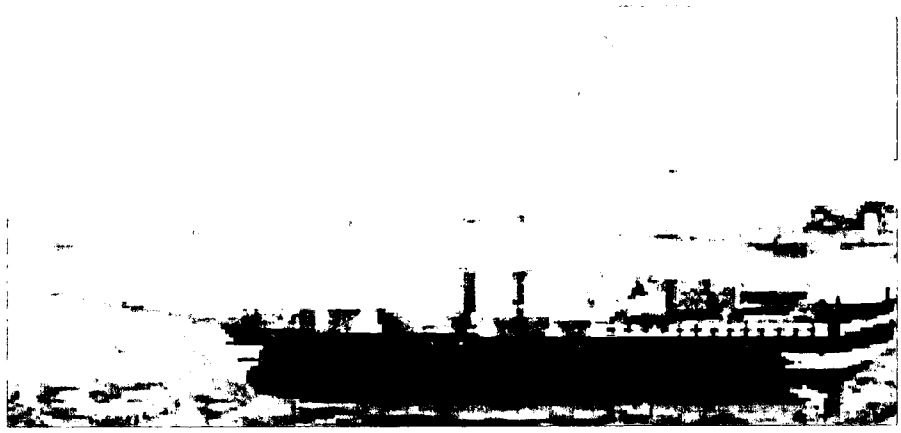
ABSTRACT

"To the Ends of the Earth and Beyond" is a curriculum-based program focusing on the role of the U.S. Navy in exploration and diplomacy throughout U.S. history. For students to have a successful experience teachers are encouraged to use as many of the activities in this packet as possible. The packet is divided into four sections: (1) "Navigation"; (2) "To the Ends of the Poles"; (3) "Commodore Perry and Japan"; and (4) "Undersea Exploration." It contains activities that develop skills in writing, reading, researching, critical thinking, and creative expression, while providing a historical look at important naval accomplishments. It is appropriate for students in grades 4-8. Contains an answer key. (BT)



To the Ends of the Earth and Beyond

DEPARTMENT OF THE NAVY -- NAVAL HISTORICAL CENTER
805 KIDDER BREESE SE -- WASHINGTON NAVY YARD
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13 November 2002

DEPARTMENT OF THE NAVY – NAVAL HISTORICAL CENTER
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To the Ends of the Earth and Beyond

TO THE TEACHER

To the Ends of the Earth and Beyond is a curriculum-based program focusing on the role of the United States Navy in exploration and diplomacy throughout history. In order for your students to have a successful experience we encourage you to use as many of the activities in this packet as possible. This packet is divided into four sections (Navigation, To the Ends of the Poles, Commodore Perry and Japan, and Undersea Exploration)and contains activities that develop skills in writing, map reading, researching, critical thinking, and creative expression, while providing a historical look at important naval accomplishments.

To the Ends of the Earth and Beyond is most appropriate for students in grades 4 through 8. We hope your students will incorporate what they have learned from these materials with exhibits at The Navy Museum for a more fulfilling educational experience.

If you have any suggestions about this program or any other comments, please telephone the Education Department at (202) 433-6826 or (202) 433-4995.

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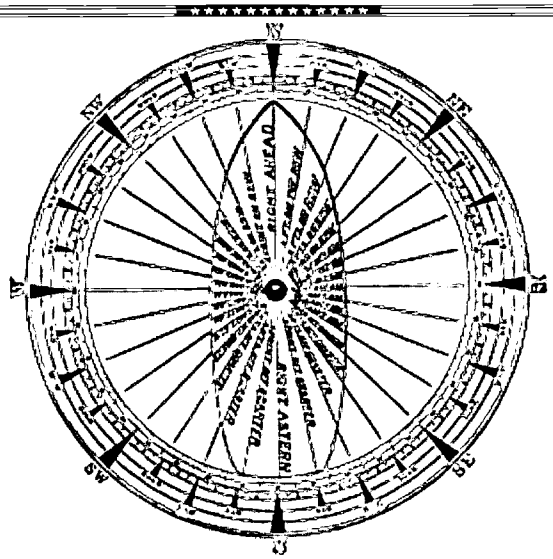

Navigation

Background

Navigation, in its simplest form, means to find your way to a point and back again. For sailors, navigation means guiding a ship through water without the help of road signs. Early sailors navigated in inland rivers and waterways which was simple. When sailors ventured out into the sea, they remained close to the coastline, using towns and the shoreline to mark their journey. A sailor's feel for the sea, the directional guidance of the sun, landmarks, and oral directions framed the earliest navigational aids.

Later, sailors looked to the heavens for a more reliable means of navigation. The development of the compass and the quadrant allowed sailors to move with some certainty on the sea. Using the North Star as a landmark, sailors sighted the star with a quadrant, measured the angle from the horizon and identified the latitude. Once the ship reached the correct latitude, it sailed east or west to reach its destination. Sailors could tell how far they were going in either direction by locating the lines of longitude. Nautical direction was determined by the magnetic needle of a compass. In the days of sail, courses and bearings were given in *points* around a compass.

Soon, sailors began to draw charts and record their paths and directions. In 1842 Matthew Fontaine Maury, a United States Naval officer, instituted a series of *Wind and Current Charts and Sailing Directs*. These charts and publications established ship lanes and revolutionized navigation on the seas. In the 20th century navigation became more reliable and sophisticated. During World War II, sailors used different types of radio wave navigation to help planes and ships find their locations, as well as find enemy ships. Today, sailors on most large ships use satellite and computer technology, such as GPS (Global Positioning Satellietes), to guide them on the seas.

Activities

- Biography: Matthew Fontaine Maury
- Research and Report
- Vocabulary
- Word Search
- Charting the Seas: Latitude and Longitude Activities
- Other Navigation Activities

Biography

Matthew Fontaine Maury (1806-1872)

Nicknamed "Pathfinder of the Seas," Matthew Fontaine Maury made important contributions to charting wind and ocean currents. His studies proved that by following the winds and currents ships could cross the ocean in fewer days than ever before.

In 1825 at age 19, Maury joined the United States Navy as a midshipman on board the frigate *Brandywine*. Almost immediately he began to study the seas and record methods of navigation. When a leg injury left him unfit for sea duty, Maury devoted his time to the study of navigation, meteorology, winds, and currents. His hard work on and love of plotting the oceans paid off when he became Superintendent of the Naval Observatory and head of the Depot of Charts and Instruments. Here Maury studied thousands of ships' logs and charts. He published the *Wind and Current Chart of the North Atlantic*, which showed sailors how to use the ocean's currents and winds to their advantage and drastically reduced the length of ocean voyages. Maury's uniform system of recording oceanographic data was adopted by navies and merchant marines around the world and was used to develop charts for all the major trade routes.

With the outbreak of the Civil War, Maury, a Virginian, resigned his commission as a U.S. Navy commander and joined the Confederacy. He spent the war in the South, as well as abroad in England, acquiring ships for the Confederacy. Following the war, Maury accepted a teaching position at the Virginia Military Institute in Lexington. He died in 1872 during a lecture tour.

Something to Think About:

"Our planet is invested with two great oceans; one *visible*, the other *invisible*; one *underfoot*, the other overhead; one *entirely envelopes it*, the other *covers about two thirds of its surface*."

Matthew F. Maury
From *The Physical Geography of the Seas and Its Meteorology,* 1855

- Read the quote two or three times. What are the two great oceans Maury mentions?
- Why are both important to mariners?

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Research and Report

1. Research the following forms of navigation below and explain when and how sailors used each. What were the positive and negative aspects of earlier navigation? What are the positive and negative aspects to modern forms of navigation?

Dead Reckoning

Electronic Navigation

Celestial Navigation

GPS

2. Name three navigational tools used before electronic navigation machines were developed. How did these earlier tools work?

3. Some sailors use stars to navigate. What were the most important stars to sailors and why? What devices did sailors use before electronic navigation was invented if they could not see the stars?

4. Why is it important to know the ocean's winds and currents when navigating?

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Navigation Vocabulary

1. **Celestial**- Objects or things related to the sky

2. **Chart**- A mariner's map

3. **Compass**- an instrument used to determine directions; a freely floating magnetized needle that points to magnetic North.

4. **Current**- a large flow of air or a large body of water moving in a certain direction.

5. **Equator**- the imaginary line of latitude circling the middle of the Earth, which is equidistant from the North and South Poles. The equator marks 0 degrees latitude.

6. **Helm**- the wheel, tiller, or steering apparatus of a ship

7. **Horizon**- the line where the sky and the land or water appear to meet.

8. **Hydrography**- the science of the measurement, description, and mapping of the surface water of the earth for use in navigation.

9. **Landmark**- an easily visible land feature that serves as a guide.

10. **Latitude**- imaginary lines running east and west on a globe used to measure distances north and south of the equator.

11. **Longitude**- imaginary lines on a globe running north and south through the North and South poles, used to measure distances east and west of the Prime Meridian.

12. **Meridian**- another name for lines of longitude; the Prime Meridian is the line of longitude that runs through Greenwich, England, and is designated as 0 degrees longitude.

13. **Navigate**- to guide a ship or vessel across a sea or body of water.

14. **Quadrant**- an instrument used in navigation and astronomy for measuring the angle of celestial bodies above the horizon.

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Charting the Seas
Word Search

Find the words from the vocabulary list in the puzzle below. Words may be diagonal, horizontal, vertical or backwards.

I	Q	U	A	T	L	O	N	G	I	T	U	D	E
A	S	H	O	R	I	Z	O	N	H	C	M	E	B
I	L	I	Y	L	A	N	D	M	A	R	K	D	U
T	Q	U	A	D	R	A	N	T	P	V	S	U	Q
S	Y	M	V	U	R	N	A	V	I	G	A	T	E
E	Z	E	W	R	N	O	T	D	S	C	F	I	Q
L	A	R	Y	B	C	R	G	S	U	D	H	T	U
E	X	I	U	J	A	E	A	R	M	L	I	A	A
C	E	D	D	H	T	P	R	N	A	I	F	L	T
P	V	I	C	L	M	E	I	A	R	P	B	H	O
R	W	A	X	O	N	S	C	M	L	E	H	J	R
P	B	N	C	T	G	A	M	I	N	A	V	Y	T

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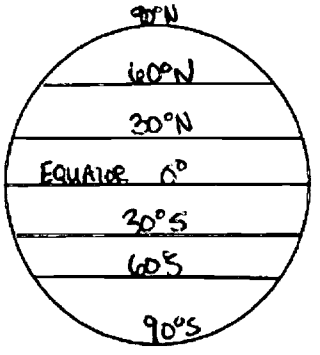
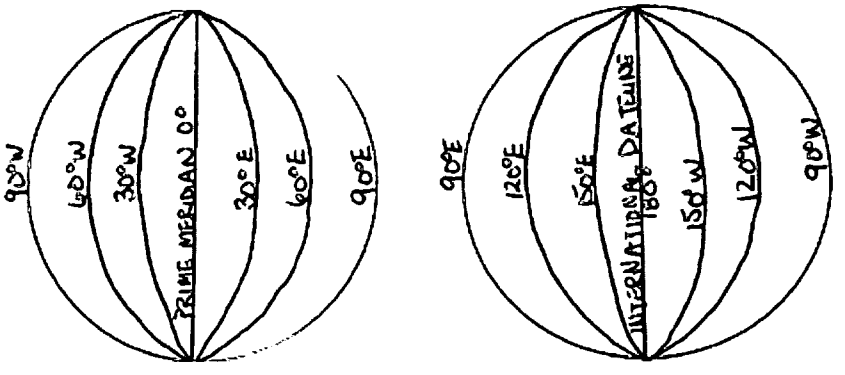
Charting the Seas: Latitude and Longitude Activities

Coordinates help us find locations anywhere without the use of street signs, street blocks, or other kinds of markings. We use coordinates called **latitude** and **longitude** to help us find locations on the open sea. When coordinates are written, latitude is always listed first, then longitude.

Latitude and longitude are imaginary lines on a globe. The lines that run east and west, parallel to the equator are called **latitude**. These lines are written in degrees (°) north and south of the equator. Each degree of latitude is divided into 60 minutes and each minute into 60 seconds, as if you were telling time. A degree of latitude measures about 69 miles on the earth's surface. The equator is at 0° latitude, while the North Pole is at 90° north and the South Pole is at 90° south.



The lines that run north and south are called lines of **longitude**. Meridian is another name for a line of longitude. An international committee agreed to call the meridian that passes through Greenwich, England, the Prime Meridian. The meridian that is halfway across the world from the Prime Meridian is 180° longitude and is called the International Date Lines of longitude are also written in degrees (°) east and west of the Prime Meridian and International Dateline.



Now test your knowledge of latitude and longitude by completing the Charting Activity.

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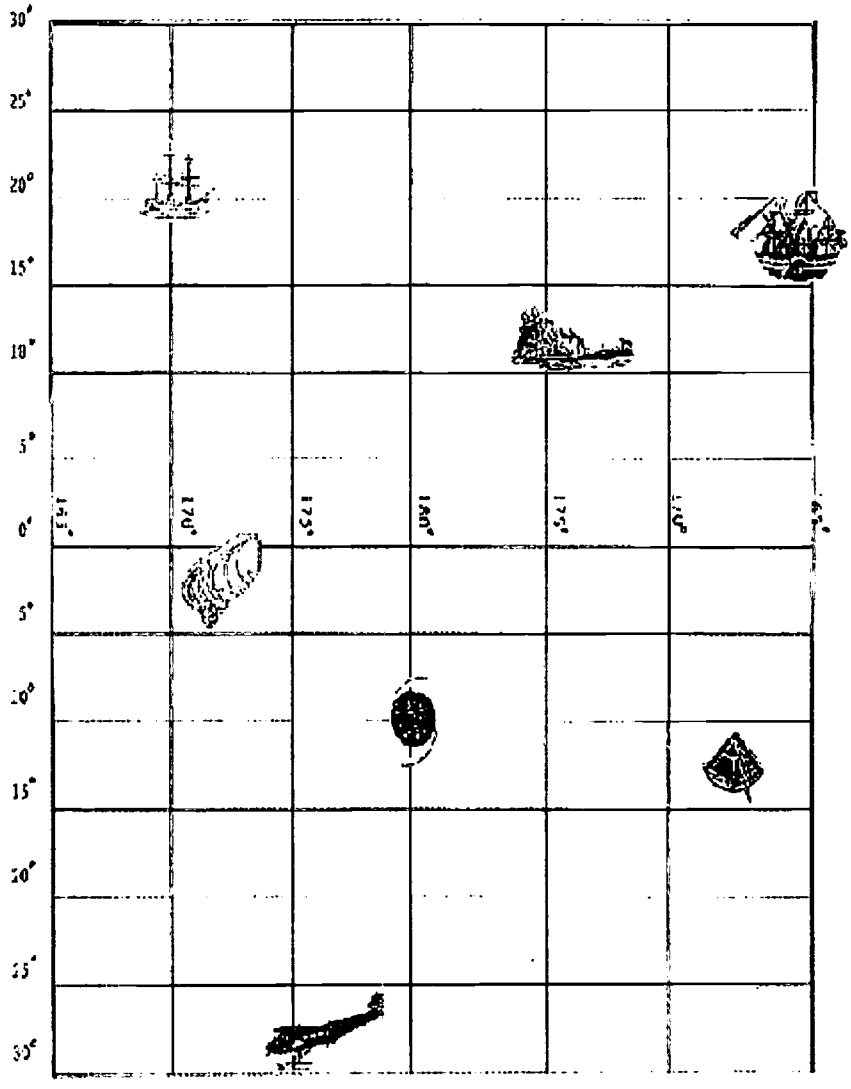
Charting the Seas

Using the chart below, find the exact position, latitude and longitude, of each object.

Object	Latitude	Longitude
Frigate 		
Richard E. Byrd's Airplane 		
Space Capsule 		
Trieste 		
USS Powhatan 		
Hurricane 		
Quadrant 		

Locate latitude and longitude from the center point of each figure.


30°
25°
20°
15°
10°
5°
0°
5°
10°
15°
20°
25°
30°
170°
175°
180°
175°

Questions and Activities

The following activities may be completed individually or as a group.

1. Imagine that you need to give directions to someone from your school to your home. You may write the directions any way you would like, for example, using landmarks, directional terms, or distance. Remember that this person has never been to your home before, so your directions must be detailed and precise. What tools or clues do you think are most effective when giving someone directions?

2. Using a local road atlas or map of your community, find the precise latitude and longitude of your local hospital, school, and public library. Using the same map or atlas describe how you would get to each location from your home. What is the distance to each location from your home? Use the distance chart at the bottom of the map.

For questions 1 & 2 be sure that you bring in a copy of the map or atlas pages that you used so your teacher can better understand your directions.

3. Do you think it is easier to map a course on land or on the ocean? Why?

4. Imagine you are on a ship trying to get from your classroom to another class, gym, or playground at your school. Working in a team or on your own, create a map. Provide directions (left and right) and approximate distances (4 steps, 30 seconds). When maps are complete exchange them with your classmates and see if you can follow their maps.

5. Using a globe or map find lines of longitude and latitude. Can you find the approximate location of Washington, DC? Try to find the following locations and list their latitude and longitude:

Los Angeles, CA

Mexico City, Mexico

Houston, TX

Mississippi River

There may be more then one degree of latitude and longitude for these areas of the world. That's okay! You only need to pick one.

6. Using a globe, find these coordinates. Write down their location.

41°N 86°W
39°N 114°W
90°N 26° W

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Commodore Perry and the Opening of Japan

Background

On March 31 1854 representatives of Japan and the United States signed a historic treaty. A United States naval officer, Commodore Matthew Calbraith Perry, negotiated tirelessly for several months with Japanese officials to achieve the goal of opening the doors of trade with Japan.

For two centuries, Japanese ports were closed to all but a few Dutch and Chinese traders. The United States hoped Japan would agree to open certain ports so American vessels could begin to trade with the mysterious island kingdom. In addition to interest in the Japanese market, America needed Japanese ports to replenish coal and supplies for the commercial whaling fleet.

On July 8,1853 four black ships led by USS *Powhatan* and commanded by Commodore Matthew Perry, anchored at Edo (Tokyo) Bay. Never before had the Japanese seen ships steaming with smoke. They thought the ships were "giant dragons puffing smoke." They did not know that steamboats existed and were shocked by the number and size of the guns on board the ships.

At age 60, Matthew Perry had a long and distinguished naval career. He knew that the mission to Japan would be his most significant accomplishment. He brought a letter from the President of the United States, Millard Fillmore, to the Emperor of Japan. He waited with his armed ships and refused to see any of the lesser dignitaries sent by the Japanese, insisting on dealing only with the highest emissaries of the Emperor.

The Japanese government realized that their country was in no position to defend itself against a foreign power, and Japan could not retain its isolation policy without risking war. On March 31, 1854, after weeks of long and tiresome talks, Perry received what he had so dearly worked for--a treaty with Japan. The treaty provided for:

1. Peace and friendship between the United States and Japan.
2. Opening of two ports to American ships at Shimoda and Hakodate
3. Help for any American ships wrecked on the Japanese coast and protection for shipwrecked persons

4. Permission for American ships to buy supplies, coal, water, and other necessary provisions in Japanese ports.

After the signing of the treaty, the Japanese invited the Americans to a feast. The Americans admired the courtesy and politeness of their hosts, and thought very highly of the rich Japanese culture. Commodore Perry broke down barriers that separated Japan from the rest of the world. Today the Japanese celebrate his expedition with annual black ship festivals. Perry lived in Newport, Rhode Island, which also celebrates a Black Ship festival in July. In Perry's honor, Newport has become Shimoda's sister city.

Activities

- Biography: Matthew Calbraith Perry
- Vocabulary
- Perry's Longitude and Latitude Activity
- Japanese Class System Explored
- Guess Who? Activity
- "It's the Thought That Counts" Activity
- Discussion Questions
- Answer Key

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Biography
Matthew C. Perry (1794-1858)

Commodore Matthew Calbraith Perry's naval career spanned nearly 50 years. A member of one of the most illustrious American naval families, young Matthew went to sea in 1809 at age 15, under the command of his older brother, Oliver Hazard Perry. His first command was the schooner *Shark* that sailed to Africa as part of the Navy's efforts to stop the transatlantic slave trade. Perry gained a reputation for taking great effort to insure the health of his crew but also for enforcing strict discipline. During the Mexican War, Perry successfully commanded the largest American naval force. Following the war, Perry devoted much of his time ashore promoting reforms for training naval officers and for expanding the Navy's use of steam power. An advocate of steam engines, Perry became known as the "father of the steam navy."

Perry's grandest accomplishment began in 1850 when he proposed a plan for diplomatic missions to Japan. In 1853 Commodore Perry sailed on USS *Mississippi*, to head the expedition to Japan. He carried a letter from President Millard Fillmore to negotiate a treaty with the Japanese. Perry's diplomacy and determination made the expedition a success. Japan opened its borders, regularly, to a western nation for the first time in more than 200 years. After returning to the United States, Perry wrote a report of his expedition that was published in 1856. After a long naval career, Commodore Perry died just a few years later in 1858.

Perry Longitude and Latitude Activity

Commodore Perry traveled all over the United States and the world. Use your navigation skills to plot the latitude and longitude of some of the places Perry visited.

Place	Latitude	Longitude
Liberia (North Africa)		
Mexico City, Mexico		
Newport, RI		
Shimoda, Japan		

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Vocabulary

1. **Diplomacy**- the practice of conducting negotiations between nations.

2. **Feudal State**- a system of political organization in which a lord and his vassals hold land with tenants working the land and paying fees to the lord for protection.

3. **Flagship**- the ship that carries the commander of a fleet and flies his flag

4. **Fleet**- a number of warships under a single command

5. **Isolationism**- a policy of prohibiting alliances and other international political and economic relations with other countries.

6. **Negotiate**- to talk with one another so as to bring about an agreement or settlement.

7. **Pacific Ocean**- a body of water bordering the west coast of the Americas and the east coasts of Asia and Japan.

8. **Port**- a harbor town or city where ships may take on or unload cargo

9. **Squadron**- a group of ships gathered together for a specific purpose.

10. **Treaty**- a contract in writing between two or more political authorities.

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Japanese Class System

The Japanese considered Westerners barbarians. Westerners considered the Japanese uncivilized. Though not an industrial country the Japanese society was complex. Arts and culture flourished in Japan under a highly structured government and class system. The Japanese lived under rules that governed every aspect of their lives according to a person's inherited status. Each level of the class system held a different responsibility and importance for the Japanese society.

Emperor- Although at the head of the class system and Japan's religious leader, the emperor had no real power. Confined to the palace grounds, he spent his time studying and writing poetry. He was spied upon and not permitted visitors without the Shogun's permission. Revered as a god, the emperor was treated as a prisoner of the Shogun.

Shogun- Shogun protected the nation against foreigners. In truth, the Shogun was the power behind the throne. He ruled the country by creating the laws and rules of conduct. As the lawmaker, the Shogun was not subject to many of these laws.

Daimyos (lords)- Daimyos were landowners and were heavily regulated by the Shogun's laws. Without his approval, a Daimyo could not marry. The number of their laborers and the size of their castles also were determined by law. They were allowed to socialize only within their own district to prevent possible plotting. They were kept from becoming too wealthy and powerful by paying for the repairs of castles, roads, and forts. When the

Americans arrived there were about 250 Daimyos and 35,000 samurai working as their knights.

Samurai- Samuri were fierce warriors and also masters of farmers, artisans and merchants. Samurai enjoyed cherry blossom viewing, poetry, and flower arranging. Many were excellent poets, painters, and men of learning. A samurai depended on his Daimyo for a meager salary.

Farmers- Farmers were 80 percent of Japan's population at the time of Perry's arrival, most farmers lived below the poverty level. Their home and quality of life was determined by the amount of rice grown.

Artisans and Merchants- Although considered part of the lower class, the artisans and merchants were one of the wealthiest classes. The superb craftsmanship of artisans enabled them to accumulate a great deal of money and foodstuffs. Like the emperor, they were spied upon by the Shogun and Daimyos and had to carry out most of their trading with caution. If they appeared too luxurious, the government would confiscate their business. Merchants gradually broke out of the rules of their class as the Daimyos and samurai came to them for financial help. By the end of the 19th century merchants were becoming very powerful and may have influenced the Japanese decision to negotiate with Perry.

Guess Who?

1.I was the religious leader of Japan. I lived in a palace but I was not allowed to leave the palace grounds.

Who am I? _____

2. I led the squadron from the United States to Japan. I served in the Navy for many years, but this was my most important mission.

Who am I? _____

3. When the Japanese saw me for the first time, they thought I looked like dragons puffing smoke.

What am I? _____

4. I led Commodore Perry's fleet into Edo Bay and hosted an important banquet.

What am I? _____

5. I was a master of farmers, artisans and merchants. I was also a fierce and feared warrior.

Who am I? _____

6. I sent Commodore Perry to negotiate a treaty with Japan. I was the leader of my country.

Who am I? _____

7. I was achieved after much negotiating between Japan and the United States.

What am I? _____

8. We were the two Japanese ports opened to American ships in 1854.

What are we? _____

9. I am a celebration held in Newport, Rhode Island, and Shimoda, Japan, to commemorate peace between Japan and the United States.

What am I? _____

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25 November 2002

"It's the Thought That Counts" Activity

In order to win over the Japanese, Perry depended not only on the strength of his fleet and negotiation skills but also on the presentation of gifts to his hosts. The Japanese reciprocated by giving the Commodore and his officers presents from the Emperor. Perry further attempted to extend diplomacy to the banquet table by hosting a gala dinner party for the Japanese on board his flagship, USS *Powhatan*. Each guest was encouraged to take home leftovers, as was the Japanese custom.

Below is a list of some of the gifts each nation presented to the other. Put a "J" next to the gifts presented by the Japanese and an "A" next to the ones presented by the Americans to the Japanese.

Lifeboats	Clocks
Silk	Farm Tools
Unusual sea shells	Telegraph wire
Porcelain tea sets	Telescope
Lacquer boxes and trays	Umbrellas
Whiskey/wines	Jars of soy sauce
Miniature railroad	Pistols/swords

The cultures of Japan and the United States have changed since 1854. Think of the technology and resources of each country. Make a list of gifts that the two countries might exchange today. Draw a special gift you might

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Discussion Questions

The following can be answered individually or as a group.

1. What geographic, economic, technological and government features added to the isolation of Japan?
2. What skills do you think are necessary to be an effective diplomat? How did Matthew Perry use these skills? Was he an effective diplomat? Why or why not?
3. Describe some of the cultural differences between the Japanese and the Americans before the treaty. What aspects of Japanese culture have been adopted in the United States? Examples: work ethic, ceremonies, and technology. Are there aspects of American culture that have been adopted by the Japanese? Examples: television, music, and technology. Compare and contrast the relationship between the United States and Japan in 1854 to the relationship between the two countries today. What events have occurred to influence their relationship?

Activities

1. Imagine you are a villager in Edo Bay. Write a letter to a friend describing the American arrival in Japan. Imagine you are a sailor with the American squadron. Write a letter to a friend describing the banquet given by the Japanese in honor of the Americans.
2. Write or act out how you think a conversation between American sailors and the Japanese villagers might have sounded. What do you think they would have talked about? Would they be able to understand everything that was said? What other means besides speech might they use to convey their message? Can you demonstrate?
3. Put together a list of "gifts" you would present to the people of another country who had never seen Americans before.

25 November 2002

The Navy Travels to the Poles

Background

By the late 1800s, the northern and southern polar regions remained some of the last unexplored areas on Earth. Looking for the Northwest Passage to Asia and later the North Pole, sailors from many countries journeyed towards the Arctic regions at the top of the world. Antarctica, the southernmost part of the world, was regarded with equal enthusiasm. The discovery by U.S. Navy Lieutenant Charles Wilkes that Antarctica was a continent, not several ice islands, increased the world interest in exploring the coldest place on Earth.

Since the 1840s the United States Navy has played an active role in exploring the Arctic and Antarctic regions. Among the list of renowned naval polar explorers are Admirals Robert E. Peary and Richard E. Byrd. Their remarkable endeavors opened doors to the North and South Poles.

Admiral Peary made five expeditions to the Arctic between 1891 and 1909 covering more than 10,000 miles. On 6 April 1909, Admiral Peary claimed to have reached the ultimate destination of 90 degrees north. With the help of African American explorer Mathew Henson and four polar natives, Admiral Peary achieved his lifelong dream.

Admiral Byrd spent 29 years exploring Antarctica. Beginning in 1928, Byrd established a base on Antarctica, Little America. In 1929, he was the first person to fly over the South Pole. Byrd's success with polar air expeditions encouraged him to undertake a land expedition through Antarctica in 1933. He and a team of men set up a tiny weather hut 123 miles inland from Little America. During this seven-month experiment Byrd conducted meteorological observations and endured a series of harrowing events that tested the limits of his physical and mental strengths. One prominent naval officer who

accompanied Byrd was Captain Finn Ronne. Byrd continued his work in Antarctica through 1956 and received the Medal of Freedom for his lifetime contribution to polar exploration.

Commander William R. Anderson continued the Navy's tradition of polar exploration with his journey from the Pacific to the Atlantic Oceans under the polar ice cap in the nuclear submarine *Nautilus* in 1958. Later that year, Commander James F. Calvert in USS *Skate* successfully broke through the ice and surfaced at the North Pole. Thus, a polar route to strategic spots in the Arctic was opened for U.S. Navy nuclear submarines.

In 1959 twelve nations signed an international treaty agreeing to keep Antarctica free of all military operations. Scientists from each nation agreed to participate in scientific studies of the continent. Admiral Byrd's vision, that "Antarctica in its symbolic robe of white will shine forth as a continent of peace as nations working together there in the cause of science set an example of international co-operation," is being fulfilled today.

Activities

- Biography: Finn Ronne
- Polar Time Line
- Polar Opposites
- Polar Maps
- Polar Projects Questions and Activities
- Polar Journals
- Antarctic Treaty System
- Answer Key

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25 November 2002

Biography: Captain Finn Ronne
1899-1980

Finn Ronne was born 20 December 1899 in Horten, Norway. His father, Martin Ronne, was a polar explorer and served in Roald Amundsen's successful expedition to the South Pole. It may have been his father's influence that inspired Finn Ronne to spend years of his life mapping and exploring Antarctica.

In 1923 Captain Ronne immigrated to the United States and gained U.S. citizenship in 1929. As a proficient athlete, naval architect and engineer, Ronne took part in two of Richard E. Byrd's expeditions to the South Pole, and in 1939 Ronne served as Byrd's executive officer helping discover one thousand miles of new coastline.

After serving several years in the United States Navy, Ronne returned to Antarctica in the 1940's, with support of the American Geographical Society. Mapping and exploring the Weddell Sea coastline Ronne set a number of polar records. Ronne covered 3,600 miles by ski and dog sled--more than any other explorer in history. Mrs. Edith Ronne accompanied her husband on the Ronne expedition and served as research scientist and journalist. Mrs. Ronne, along with the chief pilot's wife were the first women to winter over in Antarctica.

World attention focused on Antarctica in the 1950s. The Navy organized Operation Deepfreeze to complete the mapping of Antarctica and establish centers for scientific research. Ronne, recognized for his expertise in Antarctica, was asked to be scientific and military leader for a United States Weddell Sea base. He thus became the only leader of U.S. bases in the Antarctic in command of both the scientific and military personnel.

Finn Ronne died in 1980. During his lifetime he wrote several books on Antarctica and left a legacy of outstanding Antarctic research. He received three Medals of Honor and numerous military awards for service, for geographical exploration and for the advancement of science.

Something to Think About:

1. Finn Ronne was an important explorer. He was also an immigrant from Norway. How do you think his experiences in Norway helped him as a polar explorer?

2. Brainstorm! What sort of scientific experiments can you do in very cold weather? What does a scientist need to have in order to study in a freezing environment?

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25 November 2002

The Navy Travels to the Poles Time Line

Review the time line and then answer the questions at the end of the page.

1839-1840 America's First Official Expedition to the Antarctic

1850-1851 The Grinnell Expedition

1879 *Jeannette* Expedition

1881 Greely Expedition

1901-1904 and 1910-1913 Scott Expeditions

1909 Robert E. Peary's Trek to the North Pole

1914-1916 Ernest Shackleton, veteran of Scott's expeditions.

1926 First Flight Over the North Pole

1947-1948 Ronne Antarctic Expedition

1958 *Nautilus* Sails Under the North Pole

1961 Antarctica Treaty Enacted

Questions

Categorize the expeditions on the timeline under the headings below:

North Pole **South Pole**

Pick one of the countries (other then the United States) that signed The Antarctic Treaty System in 1961. Create a timeline of polar exploration for that country. What sort of research did your country do in the Antarctic? Was it similar to research done by American scientists?

1. Members of the *Jeannette* Expedition were trapped in the Arctic Sea for many months. How did the survivors escape? What lessons did the Navy learn about the Arctic after this tragic disesater?

Polar Opposites

The North and South Poles are at opposite ends of the earth. Below are characteristics of each area.

Arctic Circle/ North Pole	Antarctica/ South Pole
An almost landlocked sea of frozen ice covers the North Pole.	Antarctica is a huge continent, the center of which is the South Pole. It is a roughly circular landmass between 5 and 6 million square miles, about the size of Africa.
The Center of the Arctic Circle is the 10,000-foot deep Arctic Ocean, which is really a branch of the Atlantic Ocean	The center of the continent is a high plateau hidden under a perpetual ice cap, 9,000 feet thick at the pole.
The land that surrounds the North Pole includes Greenland, northern Scandinavia, the northern territories of Siberia and parts of Alaska and northern Canada.	Antarctica is surrounded by the Antarctic Ocean, which contains the southernmost parts of the Atlantic, Pacific and Indian Oceans.
The Arctic region is, on the average, 35 degrees warmer than Antarctica.	Antarctica is one of the coldest, windiest, driest, and highest places on Earth. Temperatures average minus 70 to minus 80 degrees Fahrenheit in the winter. The coldest recorded temperature is minus 128.6 degrees Fahrenheit.
A range of animals lives in the Arctic Circle including polar bears, hares, gulls, gullemots and zooplankton.	Antarctica is a frozen desert. It receives less than 2 inches of precipitation a year. Nothing lives there except lichens, mosses, fungi and fresh water algae. Penguins, seals are found along the coast and reproduce in the Antarctic waters.
The northern polar region has been the home of the Inuit (commonly known as Eskimo) people for thousands of years.	Unlike the northern Polar Regions, Antarctica is uninhabited by humans. Scientists and researchers from many nations live and work there today.

Polar Maps

Look at a globe or an atlas. Make a list of the landmasses and bodies of water surrounding the Polar Regions.

Arctic Circle/North Pole **Antarctica/South Pole**

Using a map or globe, locate the Polar Regions listed below. Give each location's latitude and longitude.

Place	Arctic or Antarctica	Latitude	Longitude
Peary Land			
North Pole			
South Pole			
Byrd Station			
South Shetland Islands			
West Spitsbergen			

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Polar Projects

1. Looking at a map or globe, sketch the Arctic or Antarctic and their surrounding regions. Using the chart on the next page, sketch either region. Try to position your drawing to meet the correct latitudes and longitudes of the real location. Locate three other landmarks on or around the region you have chose. Find their latitude and longitude and mark them on your chart.
2. Design a house that would be suitable for life in the Polar Regions. You may need to do some research to identify types of materials you would use. Draw a sketch of your house.
3. Prepare a packing list of the things you would take with you on a trip to the Polar Regions. Identify the uses and importance of each object.

Ponder these Polar Problems

1. Seasons occur because of the rotation of the Earth on an axis around the sun. Do polar regions have seasons? Why or why not?
2. The Arctic and Antarctic waters contain a variety of animal life. How do these animals survive in such harsh conditions?
3. Choose an animal that lives in the Polar Regions. Research and report on this animal and its methods for adapting to a frigid environment.

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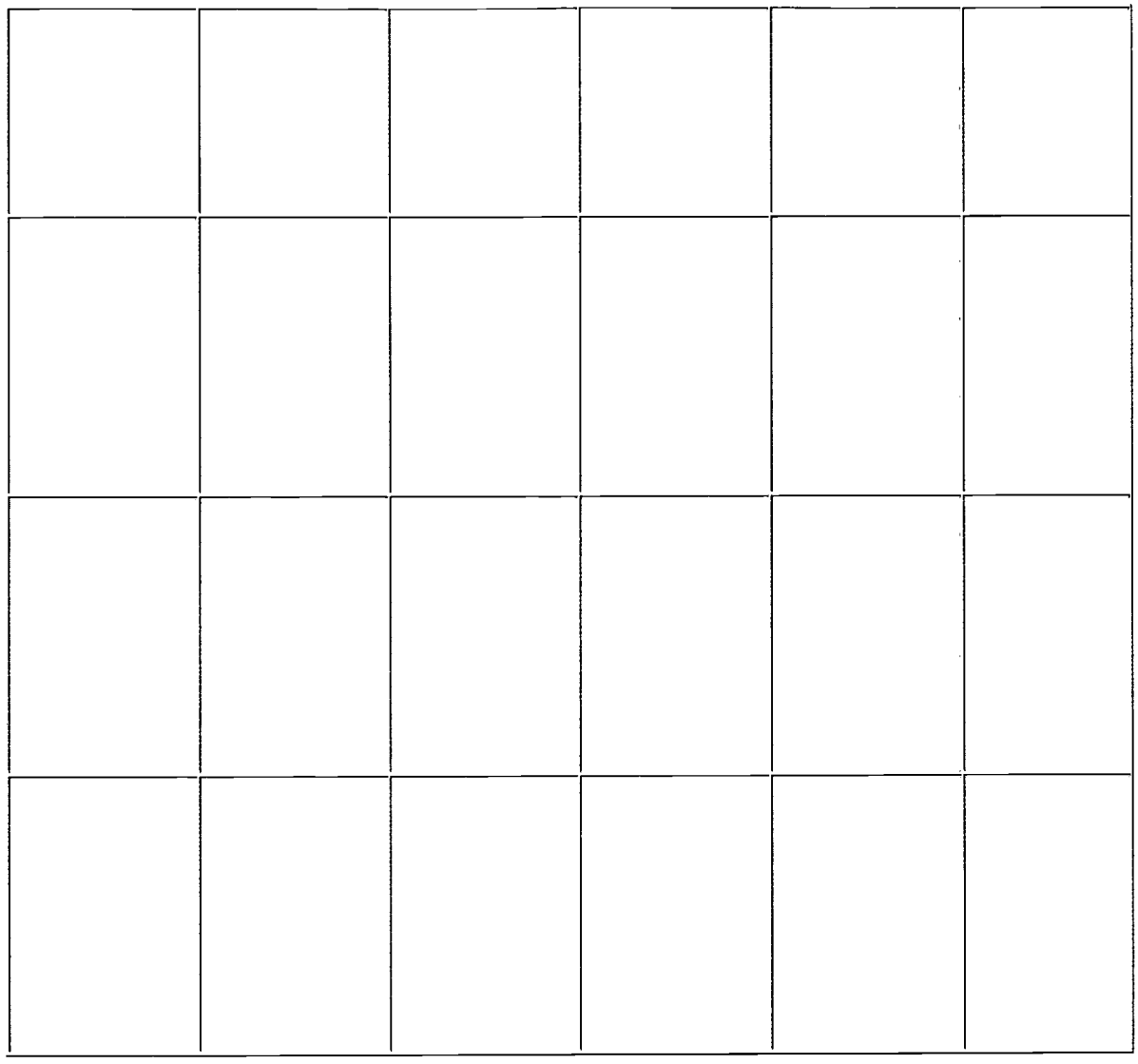
Arctic/Antarctic Chart



2 December 2002

Polar Journals

Many polar explorers kept journals and wrote books about their experiences in the Arctic and Antarctica. Below are excerpts from books written by two polar explorers, Matthew Henson and Richard Byrd. Read them and complete the exercises that follow.

Matthew Henson

Commander Peary and I were alone (save for the four Esquimos), the same as we had been so often in the past years, and as we looked at each other we realized our position and we knew without speaking that the time had come for us to demonstrate that we were the men who, it had been ordained, should unlock the door which held the mystery of the Arctic.

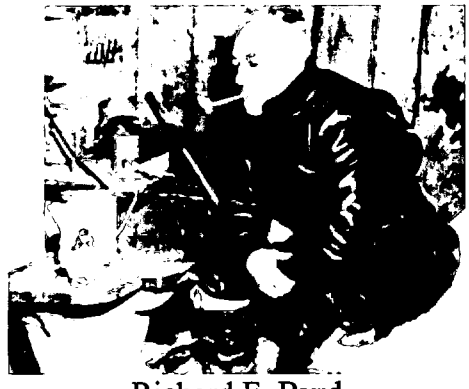
It was about ten or ten-thirty a.m. on the 7th of April, 1909, that the Commander gave the order to build a snow-shield to protect him from the flying drift of the surface snow. I knew that he was about to take an observation and while we worked I was nervously apprehensive, for I felt that the end of our journey had come...

Matthew A. Henson

Photo used with permission from Matthew Henson Elementary School
Text from: *A Black Explorer at the North Pole*, a 1989 reprint of the 1912 edition

Richard E. Byrd

By May 17th, one month after the sun had sunk below the horizon, the noon twilight was dwindling to a mere chink in the darkness, lit by a cold reddish glow. Days when the wind brooded in the north or east, the Barrier became a vast stagnant shadow surmounted by swollen masses of clouds, one layer of darkness piled on top of the other. This was the polar night, the morbid countenance of the Ice Age. Nothing moved; nothing was visible. This was the soul of inertness. One could almost hear a distant creaking as if a great weight were settling.



Richard E. Byrd

U.S. Navy photograph
Text from: *Alone*, New York, G.P. Putnam's Sons, 1938

Discussion Questions

1. Describe the emotions both explorers are feeling. List words that help you identify their feelings.

2. What do you think the next entry in each journal may be?

3. What do you think these men had in common?

Activities

1. Imagine that you spent the winter alone in one of the polar regions. Write a journal entry describing what it was like. How would you feel if you were all by yourself on a cold, large continent. What would you do to keep yourself busy? What would you do for fun?

2. You have been trekking across Antarctica for many months. Write a letter to a family member describing the conditions and the things you have seen.

3. Write a newspaper headline announcing the arrival of Robert Peary or Roald Amundsen to the Poles. You may need to research each expedition to write your headline. Draw a picture to illustrate your headline.

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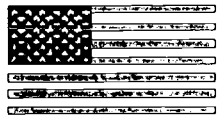
Antarctic Treaty System

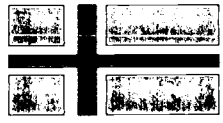
From 1957-1958, twelve countries participated in expeditions to Antarctica and established over 50 stations. The continent became a focus for studies in oceanography, meteorology, glaciology, and surveying. Since 1961, the **Antarctic Treaty System** has governed the activities of nations in Antarctica. Today 39 countries, representing all economic systems, all geographic areas and almost all political viewpoints, participate in the treaty system. Several agreements in one, the treaty is in effect an arms control measure, a claims settlement, a science compact and a framework for a limited method of administration in Antarctica affairs. Originally, there were twelve countries, including the United States, that signed the treaty to preserve Antarctica as a continent of peace.

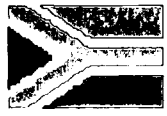
The terms of the treaty are as follows:

1. Peaceful use of Antarctica
2. Military operations, except in support of peaceful activities, are prohibited.
3. Freedom of scientific investigation and the exchange of program plans, personnel, observations, and results.
4. Nuclear testing and disposal of radioactive waste is prohibited.
5. Existing claims are not recognized and the assertion of new claims is prohibited.
6. Any treaty nation has the authority to inspect others' stations and equipment.

The following are the twelve original countries of the Antarctic Treaty (with their current national flags):

United States 

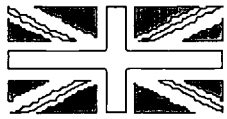
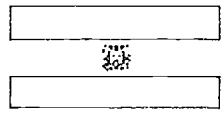
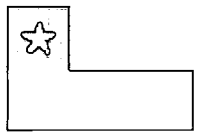
Norway 

South Africa 

France 

Belgium 

New Zealand 

Japan		USSR, now represented by Russia	
Great Britain		Argentina	
Chile		Australia	

Something to Think About

1. Do you agree with the terms of the treaty? Why or why not? If you could change the treaty what changes would you make?
2. Why do you think countries were interested in Antarctica fifty years ago? Why do you think the United States is still interested in this icy continent? What do you think would happen if the treaty were eliminated?

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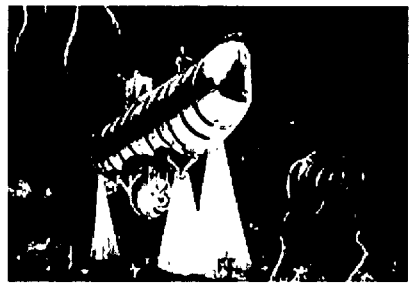

The Navy Travels Undersea

Background

From the earliest times people have sought to explore the oceans. The sheer size of the ocean and its hidden depths fed human curiosity. Imagine scenes of life, known and unknown, which inhabit the vast ocean depths. These sights, combined with the need for new fuels and food, as well as a longing for adventure, led to undersea exploration.

While exciting, there are many problems people encountered when trying to explore the depths of the sea. Lack of oxygen, cold temperatures, water pressure, and darkness forced explorers to develop machines and equipment able to keep a human alive underwater. Their inventions have made undersea exploration possible.

Essential to the exploration of the deep waters was the development of instruments and ships that could withstand the pressure at hundreds of feet below sea level. In 1947 Swiss scientist August Piccard developed the bathyscaphe. Using a specially constructed steel diving sphere and a system for propulsion, Piccard created a vessel that traveled 4,600 feet into the ocean without being tied to a surface ship. *Trieste*, one of the first bathyscaphes, was built by Piccard in 1953 and transferred to the U.S. Navy in 1958. In January of 1960, August Piccard's son, Jaques, and U.S. Navy Lieutenant Don Walsh descended in *Trieste* to a depth of 35,800 feet. The dive took place in the Marianas Trench off the coast of Guam and was completed in about eight hours.

Trieste's ability to dive deep allowed the U.S. Navy to locate a lost submarine. In 1963 the nuclear submarine *Thresher* sank. *Trieste* located the wreckage, but it was not able to retrieve many of the pieces. This tragedy sped up the development of submersibles for rescue and exploration that were not as limited in function as bathyscaphes.

In 1964 Woods Hole Oceanographic Institution's Science Research Center built the small, maneuverable submersible *Alvin*. Able to carry a pilot and two scientists, this craft could reach a depth of 12,000 feet and was equipped with a maneuverable arm. In 1966 *Alvin* was called upon to retrieve an American hydrogen bomb lost in the Mediterranean Sea after a mid-air bomber collision. With the help of surface ships and other

submersibles *Alvin* located the bomb and assisted in lifting it to the surface. *Alvin* was also used extensively to explore the ridges and vents of the oceans. These dives in the Pacific and Atlantic Oceans recorded new information about the conditions at these depths identified unknown plant and animal life. One of *Alvin*'s most famous dives was to the wreckage of the cruise ship *Titanic* in 1986. In 1989, *Alvin* celebrated its 25th anniversary, as the world's most active research submersible.

A variety of manned submersibles are in use today. These vessels can carry two or three people and descend from 600 to 36,000 feet. These underwater vehicles also discover pieces of naval history, such as the wrecks of USS *Monitor* and CSS *H.L. Hunley*. As scientists learn more about oceans, that knowledge will broaden our understanding of the natural and historical resources below the surface.

Activities

- Biography: Dr. Robert Ballard
- Undersea Vocabulary
- Challenges Undersea
- Aquanauts and Sealabs
- Activities and Questions

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2 December 2002

Biography: Dr. Robert Ballard
1942-

Dr. Robert Ballard is one of the best known underwater scientists in the United States today. Famous for his exploration of the wreck of the cruise ship, RMS *Titanic*, Dr. Ballard has always been fascinated by the sea. As a young man he learned to SCUBA dive and became involved in groups that studied the ocean. In 1967, Robert Ballard joined the U.S. Navy and was assigned to the Deep Submergence Group at Woods Hole Oceanographic Institution.

At Woods Hole, Dr. Ballard began to work with *Alvin*, a small three-man deep submergence vehicle. From 1973 to 1979, he worked with the *Alvin* team exploring the Mid-Atlantic Ridge. Following the curves of the ridge along the center and the length of the Atlantic Ocean, Ballard and the team discovered enormous red worms, underwater vents and Hot Springs. Receiving awards and notoriety for this research, Dr. Ballard was made a senior scientist at Woods Hole.

By the early 1980s, Dr. Ballard had spent more time in the deep ocean than any other scientist and had achieved enough notoriety so that he could pursue his life's dream to explore the wreck of RMS *Titanic*. Considered an unsinkable cruise ship, the *Titanic* was lost at sea in April of 1912, after striking an iceberg. Along with a French team, Dr. Ballard spent many months trying to locate the sunken ship. In the summer of 1985, they found wreckage of the ship strewn across the ocean floor and photographed the remains of the ship. Dr. Ballard returned to the wreck site a year later to dive down in *Alvin* for a closer look at the ship. Modifications to *Alvin* allowed the explorers to see inside the wreck. A cable attached to the front of *Alvin* connected *Jason Junior*, a unique remote-controlled underwater robot equipped with cameras and video equipment. With *Jason*'s help Dr. Ballard was able to walk down the grand staircase and look inside the remains of the *Titanic*.

Now retired from Woods Hole after 30 years of service, Dr Ballard continues his deep sea exploring. Recently, he discovered the resting place of the aircraft carner, USS *Yorktown*, which sunk deep in the Pacific Ocean during the Battle of Midway in 1942. He also located the wreck of *PT 109*, the patrol boat under command of former president John F. Kennedy when he was a U.S. Navy officer. Robert Ballard is president of the Institute for Exploration in Mystic, Connecticut and is "Explorer-in-Residence" at the National Geographic Society.

Something to Think About

How do you think Dr. Ballard's early hobbies and experiences helped him decide on a career?

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Undersea Vocabulary

1. **Aquanaut**- A scuba diver who lives and operates both inside and outside an underwater shelter for an extended period.
2. **Bathyscaphe**- A guided submersible ship for deep-sea exploration having a spherical watertight cabin attached to its underside.
3. **Bathysphere**- A strong steel diving sphere for deep-sea observation.
4. **Dive**- To submerge.
5. **Hull**- The frame or body of a ship.
6. **Hydrogen bomb**- A bomb whose violent explosive power is caused by the sudden release of atomic energy.
7. **Luminous**- Emitting light or glowing.
8. **Oceanography**- A science that studies the oceans, including the determination of their depth, the physics and chemistry of their waters, marine biology, and the exploitation of their resources.
9. **Propulsion**- The action or process of driving forward or onward.
10. **Sphere**- A globe or ball.
11. **Submersible**- a vessel capable of descending under water.
12. **Surface Ship**- ship that operates above the water.
13. **Woods Hole Oceanographic Institution**-A private, nonprofit research organization divided into five science departments: Applied Ocean Physics and Engineering; Biology; Geology and Geophysics; Marine Chemistry; Geochemistry and Physical Oceanography.

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Challenges Undersea

Look at ways humans have overcome water pressure, temperature, and lack of oxygen to function under water.

Water Pressure- As a person travels deeper in the ocean, water pressure increases so much that at some depths a human would be crushed from the pressure. To prevent death and allow for exploration in deep waters, the bathysphere was designed. Built with steel hulls, the bathysphere maintains normal air pressure while operating at depths of 3,000 feet. Using a bathysphere people are able to explore safely.

Explore how deep the Navy's submersibles dive using this charting activity.

Think About It! *If the pressure increases as one descends in the ocean, what do you think living creatures in the deepest part of the ocean look like?*

Temperature- As sunlight enters water, different wavelengths are absorbed by the water. The red wavelengths warm the upper layers. Descending further, at a depth of a few hundred feet, only a few rays of blue and green light remain and the water becomes cooler. Divers need protection from the cold. A **wet suit** lets in some water and keeps the diver warm by using body heat to warm the water and create a layer of insulation. An **inflatable suit** includes an insular dry air suit that maintains a comfortable temperature by pumping air to the diver through cords connected to a surface ship.

Think About It! *Sunlight does not reach the deepest parts of the ocean. As explorers go deeper and deeper, the water becomes colder and inky black. Can you imagine the explorers' surprise when they discovered luminous plant and animal life at these great depths?*

Breathing- One of the largest obstacles in exploring the oceans is breathing underwater. Explorers have developed two methods. Manned submersibles enable divers to descend to great depths in an artificial atmosphere. For free divers, those outside of a ship or untethered to a ship, breathing for long periods underwater requires a supply of oxygen. The invention of SCUBA (self-contained underwater breathing apparatus) provides divers with a tank of oxygen or mixed gases and a safe breathing device enabling them to work at depths of 500 feet and remain underwater for greater periods of time.

Think About It! *Before the invention of scuba gear people dived in the ocean for extended periods of time. How were they able to breathe?*

Charting the Depths

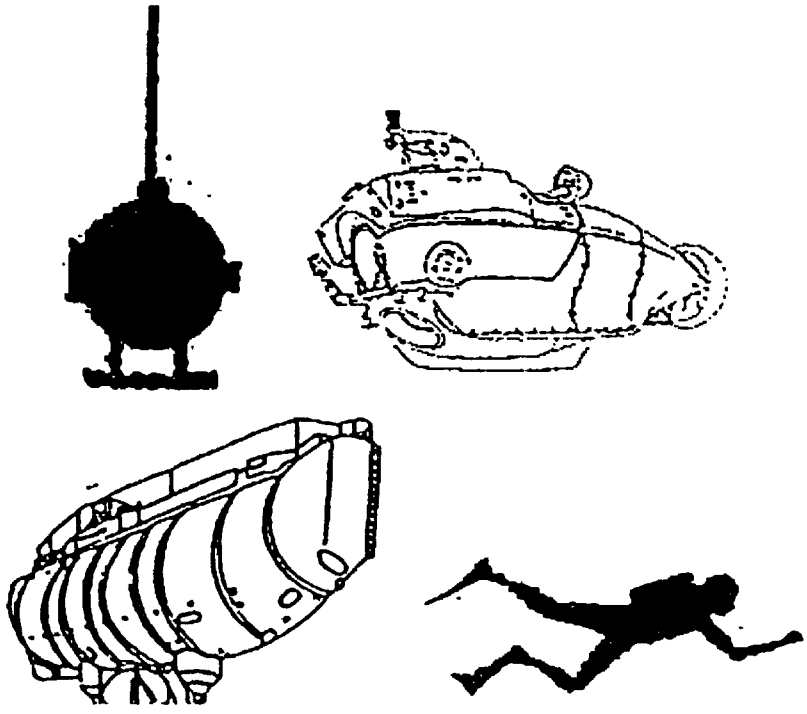
The ocean ranges in depth. Explorers use different devices to work at different depths. Use the information provided to identify the deepest depth for each ship. Cut out the objects below and place them on the chart at the correct depth level.

5,000 feet

15,000 feet

25,000 feet

35,000 feet



Find two other kinds of submersibles in use today. Where would you place them on the chart? What sort of sea life would you find at each level? Illustrate your findings on the chart.

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Aquanauts and Sealab

In 1964 the first Sealab was established. A specially designed steel chamber anchored at the bottom of the ocean, Sealab provided a scientific center from which divers, or aquanauts, could work and study the ocean for extended periods of time. As part of the U.S. Navy's Man in the Sea program, three Sealab experiments were conducted. Sealab I was the first of the Navy's underwater habitats to be submerged. It was lowered 193 feet into the waters off Bermuda. A huge hose connected the Sealab aquanauts with the world above the water.

The Sealabs were submerged to great depths beneath the surface of the ocean, where living conditions were different than on land. For instance, normal air could not be inhaled safely. The aquanauts had to breathe a mixture of gases. Helium was the main ingredient of the Sealab atmosphere, and the aquanauts end up sounding like chattering chipmunks during their stay underwater. All three of the Sealabs had stoves, refrigerators, and sinks. A large hose brought fresh water, telephone and television connections to the scientists, oceanographers, doctors, engineers, and photographers living in Sealab. Snacks and treats were sent down the hose to the Sealab crews from family members daily to insure that the underwater capsules felt like home.

The aquanauts of Sealab I fed and photographed fish and placed measuring devices on the ocean floor. They spent six hours a day working on the ocean floor. The aquanauts completed tasks in a week that normally required a year with conventional surface divers.

The Sealab II experiment lasted a year, and the habitat was larger then the Sealab I capsule. One of the most complex tasks undertaken by Sealab II scientists was the installation of an undersea weather station. And, instead of using a hose to provide the aquanauts with all of their supplies from the surface, the Navy sometimes used a trained porpoise named Tuffy. Tuffy was trained by the Navy to respond to a special buzzer. He did an excellent job bringing the aquanauts mail, tools, and even bottles of soda. Sealab II also experimented with the retrieval and repair of wreckage and equipment on the ocean bottom.

Sealab II's Tuffy

Living under the sea also allowed the Navy to harvest food and fuel in the ocean depths. The Man in the Sea program lost its sponsorship when, during a routine transfer to Sealab III, an aquanaut was killed from carbon monoxide poisoning caused by faulty equipment. This tragedy, combined with the success of astronauts in the space program, eventually resulted in the cancellation of Sealab.

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Activities and Questions

1. Make a list of reasons for exploring the ocean.
2. How are *Alvin* and *Trieste* able to solve some of the problems that scientists and explorers face when deep underwater?
3. Create a design for a deep submersible vehicle (DSV). It can be manned or unmanned. Remember that it must withstand the pressure of the deep ocean.
4. *Alvin* and *Trieste* are able to move underwater the same way as a submarine. What is the difference between these ships and submarines?
5. Why was the *Titanic* easier to explore using *Alvin* and *Jason Jr.* Why do people explore sunken ships? What can we learn from wrecks like the *Titanic*?

Discussion Questions:

The following questions can be answered individually or as a group.

1. Compare and contrast *Alvin* and *Trieste*. What are the advantages and disadvantages of each ship?
2. Ballast and diving planes are used to operate submarines and submersibles underwater. Briefly explain how each one works and how they make underwater exploration possible.
3. A ship has sunk at sea. Its exact location is unknown. How will explorers be able to find it? What methods of mapping and sonar exploration are most useful in developing a plan for finding the sunken ship?
4. There are many kinds of deep submergence vehicles (DSV). Some are built to carry scientists and pilots while others operate as robots controlled by computer systems or manual control. *Jason Jr.* is one such unmanned DSV. What are the uses of a DSV and when do scientists utilize them most?
5. Why was *Alvin*'s mission to recover the hydrogen bomb more successful then the *Trieste*'s missions to find USS *Thresher*? What were the dangers and obstacles of both missions? Were the scientists of each mission able to overcome them? How?

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Answer Key

NAVIGATION

Answers to Questions and Activities

5. Using a globe or map find lines of longitude and latitude. Can you find the approximate location of Washington, DC? Try to find the following locations and list their latitude and longitude:

- Los Angeles, CA 118° N 34° W
- Mexico City, Mexico 100° N 20° W
- Houston, TX 98° N 29° W
- Mississippi River 90° N 38° W

There may be more then one degree of latitudes and longitude for these areas of the world. That's okay! You only need to pick one.

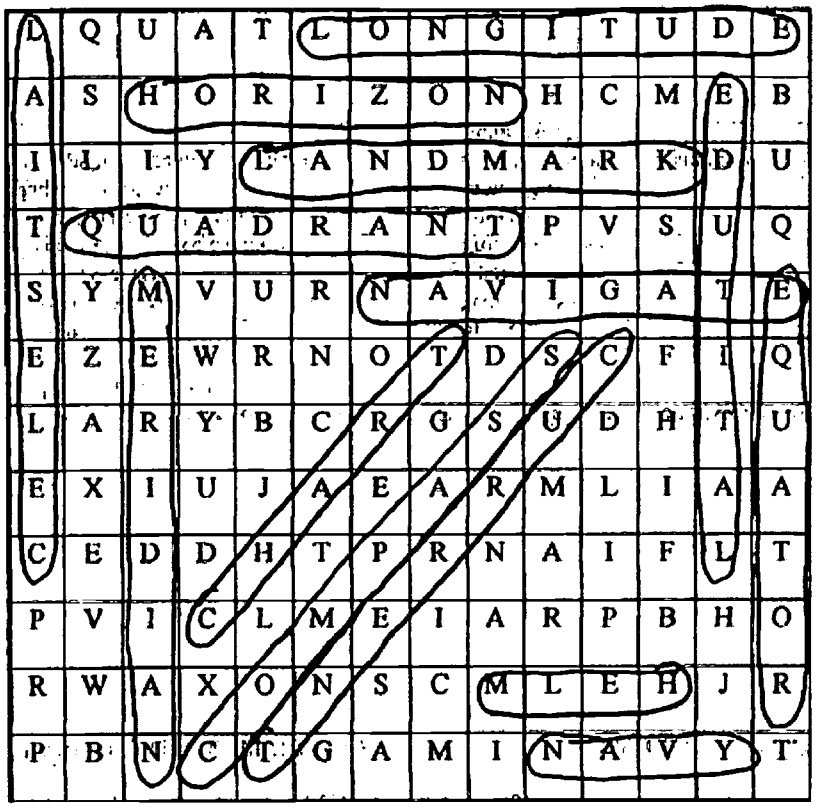
6. Using a globe, find these latitude and longitudes. What area of the United States is each one the location for?

- 41° N 86° W Chicago
- 39° N 114° W Great Salt Lake
- 90° N 26° W Gulf of Mexico

Charting the Seas

- Frigate: 20° N 170° W
- Richard E. Byrd's airplane: 28° S 175° W
- Space Capsule: 13° N 175° E
- *Trieste*: 3° S 173° W
- USS *Powhatan*: 18° N 165° E
- Hurricane: 9° S 180°
- Quadrant: 13° S 168° E

Word Search



D	Q	U	A	T	L	O	N	G	I	T	U	D	E
A	S	H	O	R	I	Z	O	N	H	C	M	E	B
I	L	I	Y	L	A	N	D	M	A	R	K	D	U
T	Q	U	A	D	R	A	N	T	P	V	S	U	Q
S	Y	M	V	U	R	N	A	V	I	G	A	T	E
E	Z	E	W	R	N	O	T	D	S	C	F	I	Q
L	A	R	Y	B	C	R	G	S	U	D	H	T	U
E	X	I	U	J	A	E	A	R	M	L	I	A	A
C	E	D	D	H	T	P	R	N	A	I	F	L	T
P	V	I	C	L	M	E	I	A	R	P	B	H	O
R	W	A	X	O	N	S	C	M	L	E	H	J	R
P	B	N	C	T	G	A	M	I	N	A	V	Y	T

COMMODORE PERRY AND THE OPENING OF JAPAN

Answers to "It's the Thought that Counts"

- lifeboat **A**
- telescope **A**
- clocks **A**
- lacquer boxes and trays **J**
- silk **J**
- umbrellas **J**
- farm tools **A**
- whiskey/wines **A**
- unusual sea shells **J**
- jars of soy sauce **J**
- telegraph wire **A**
- pistols/swords **A**
- porcelain tea sets **J**
- miniature railroad **A**

Answers to "Guess Who?"

1. I was the religious leader of Japan. I lived in a palace but I was not allowed to leave the palace grounds.

- Who am I? **Emperor**

2. I led the squadron from the United States to Japan. I served in the Navy for many years, but this was my most important mission.

- Who am I? **Commodore Matthew C. Perry**

3. When the Japanese saw me for the first time, they thought I looked like dragons puffing smoke.

- What am I? **black steamships**

4. I led Commodore Perry's fleet into Edo Bay and hosted an important banquet.

- What am I? **USS *Powhatan***

5. I was a master of farmers, artisans and merchants. I was also a fierce and feared warrior.

- Who am I? **Samurai**

6. I sent Commodore Perry to negotiate a treaty with Japan. I was the leader of my country.

- Who am I? **President Millard Filmore**

7. I was achieved after much negotiating between Japan and the United States.

- What am I? **treaty**

8. We are the two Japanese ports opened to American ships in 1854.

- What are we? **Shimoda and Hakodate**

9. I am a celebration held in Newport, Rhode Island, and Shimoda, Japan, to commemorate peace between Japan and the United States.

- What am I? **Black Ships Festival**

THE NAVY TRAVELS TO THE POLES

Answers for Polar Projects

Reading Maps:

Look at a globe or an atlas. Make a list of the landmasses and bodies of water surrounding the Polar Regions.

Arctic Circle/North Pole	**Antarctica/South Pole**
Greenland	Argentina
Northwest Territory	Weddell Sea
Arctic Sea	Ross Ice Shelf

Using a map or globe, locate the Polar Regions listed below. Give each location's latitude and longitude. Identify the direction, north, south, east and west.

Place	**Arctic or Antarctica**	**Latitude**	**Longitude**
Peary Land	Arctic	83°N	42°W
North Pole	Arctic	90°N	0°
South Pole	Antarctica	90°S	0°
Byrd Station	Antarctica	80°S	121°W
South Shetland Islands	Antarctica	63°S	58°W
West Spitsbergen	Arctic	80°N	18°E

Answers to Activities

1. Categorize the expeditions on the timeline under the headings below:

North Pole	**South Pole**
Ginnell Expedition	Wilkes Expedition
Jeannette Expedition	Scott Expedition
Greely Expedition	Ronne Expedition
Byrd's flight	Peary Expedition
Nautilus	

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