

# Educator Activity Booklet to the Arkansas Inland Maritime Museum

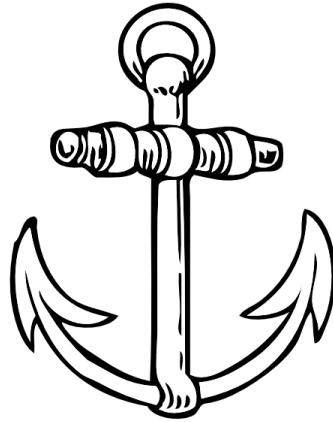


Field trips to the Arkansas Inland Maritime Museum include a guided tour through USS *Razorback* submarine and an optional age appropriate scavenger hunt through our museum. Students have a limited time at the facility, so completing activities with students at school will help them better understand submarines. There are some activities that introduce students to what submarines are and how they work; while others are follow up activities. There are four main subject areas covered: [English Language Arts](#), [Math](#), [Science](#), and [Geography](#). The activities are organized by grade level then by subject area.

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If your class would like to take a field trip to the Museum please contact us by calling (501) 371-8320 or emailing [events@aimm.museum](mailto:events@aimm.museum). We offer tours to school groups Wednesday through Saturday 10:00 AM to dusk and Sunday 1:00 PM to dusk. We do give special rates to school groups who book their field trips in advance.

## Kindergarten through Second Grade



### English Language Arts

A fun way to introduce young students to what a submarine is before visiting is by reading *The Magic School Bus on the Ocean Floor* to your students. The teacher should explain that while the bus turned into a “submarine” it is different from a submarine that is used in warfare.

After your class has visited the museum the class can create an anchor chart that shows the new vocabulary they learned. Educators can make the chart more interactive and personalized if they allow students to create their own submarine that states their word for the anchor chart. The class can make their own submarine fleet! Each submarine has a name and number that identifies them. During World War II submarines were named after animals that live in the ocean. Have students include major parts of submarines: periscope, diving planes, bridge, propellers, and rudder.

### Math

Before students visit the submarine allow them to understand that the vessel, while a warship, is also where people lived. Allow students to create a map of their homes. The map should indicate all rooms of their home (kitchen, living room, bedrooms, bathrooms, laundry room, etc.). Assist students with a class bar graph of how many rooms are in each student’s house. Then display a map of the submarine’s interior. Have students name some of the similarities and differences between their home and the submarine.

Have students complete these math problems to find out how often men could take a shower while living on a submarine. (This activity can be completed before or after their visit to the submarine.)

- If it takes 2 gallons of water to take a shower, how many gallons do you need to let 3 people take a shower? **Answer: 6 gallons.**
- If the submarine uses 6 gallons a day for showers, how many gallons a week is used? **Answer: 42 gallons.**
- If there are 84 men living on a submarine and 6 people get to take a shower a day, how many days until all men have taken a shower? **Answer: 14 days.**

## Science

Have students complete the following experiment to learn about pulleys. Pulleys are important in loading supplies into a submarine. Each torpedo weighs around 3,000 pounds, so pulleys are very useful to lower these into the submarine.

Materials needed:

- empty spools of thread
- string
- pencils
- bunch of pencils taped together or a small weight

Experiment 1:

1. Tie the bunch of pencils or a small weight to one end of a string.
2. Then raise the bunch of pencils off the floor by pulling directly up on the string. Notice the weight of the object as you pull up.
3. Now, put a pencil through the empty spool of thread. Then loop the string over the pencil.
4. Have your partner hold the pencil and spool in the air.
5. Pull one end of the string down. Notice the weight of the object as you pull on the string and it rises into the air.
6. What do you notice about the amount of effort, or work, it takes to lift an object with a pulley?

Explanation:

We use machines such as pulleys to make our work easier. When you lift the object without the pulley you work with one rope. When you lift with the pulley, it is like working with two ropes. One side of the rope goes up the pulley, and the other side goes down. By using a simple pulley you can divide your work in half!

Experiment 2:

1. Have your partner hold a second pencil with a spool of thread under the first.
2. Loop the string around the two spools.

3. Complete experiment 1 again.

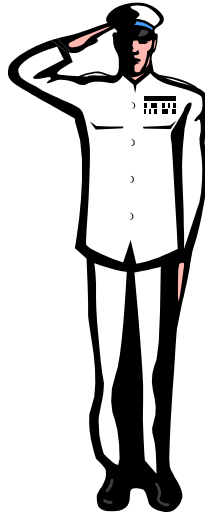
Observations:

- What do you notice about the amount of work it takes?
- Was it harder or easier with two spools?
- Can you explain what happens?
- Have students write their responses during the second experiment.

## Geography

Before your class visits the museum complete this map activity so students understand that submarines are not “native” to rivers. *Kindergarten:* Display your state map. *First Grade:* Display a United States map. *Second Grade:* Display a world map. Have the students locate their town (state and country). Then students should identify the difference between land and water. What is the closest water source to your town? What rivers are in your state? Some rivers are used to trade goods and raw materials. Use the United States Waterways Map to find out if your state’s river(s) are used for this purpose. These rivers that are used for trade eventually connect to the ocean. Find a river closest to your town and follow it to the ocean. What ocean does your river go to? Locate Arkansas on the United States Waterways Map and explain to students that a United State Naval submarine is on display in Arkansas for people to visit. Have students figure out how the submarine got to North Little Rock, Arkansas. During the map discussion use new terminology with your students such as the cardinal directions (north, south, east, and west) when explaining a location.

## Third through Fifth Grade



### English Language Arts

After your visit to the museum, have the class create an anchor chart that includes verbs, nouns, and/or adjectives that describe their field trip. Educators can make the chart more interactive and personalized if they allow students to create their own submarine that states their word for the anchor chart. The class can make their own submarine fleet! Each submarine has a name and number that identifies them. (World War II submarines were named after animals that live in the ocean.) Have students include major parts of submarines: periscope, diving planes, bridge, propellers, and rudder.

Students can complete a “What if” creative writing prompt about submarine sailors. Visit [www.aimm.museum](http://www.aimm.museum) to show photographs from USS Razorback to give students inspiration.

### Math

Have students complete the following math problems to better understand the movement of submarines.

- A submarine hovers at 140 feet below sea level. If it descends 20 feet, what is its new position? **Answer: 160 feet.**
- If periscope depth is 53 feet what is the depth to have 8 feet of periscope out of the water? **Answer: 45 feet.**
- A submarine hovers at 280 yards below sea level. If it ascends (rise) 140 yards and then descends (lower) 360 yards, what is its new position? **Answer: 500 yards.**

- What is the new position in feet? **Answer: 1500 feet.**

Have students complete the following math problems to figure out how often crew members took showers on USS *Razorback*. Submarines have to make their own fresh water, by boiling salt water and compressing the steam in the water stills aboard the submarine.

- The water stills make 1,000 gallons of fresh water a day. Of the 1,000 gallons of water  $\frac{3}{5}$  of the water is used on the engines and batteries, how much water is left? **Answer: 400 gallons.**
- Of the 400 gallons of water  $\frac{3}{5}$  of the water is used for cooking and drinking, how much water is left for hygiene? **Answer: 40 gallons.**
- Each crew member gets  $\frac{1}{4}$  gallon of water daily in a sink for hygiene, if there are 80 crew members, how many gallons of water is used? **Answer: 20 gallons.**
- How many gallons of water are left for showers? **Answer: 20 gallons.**
- If each person uses 3 gallons of water to take a shower, how many crew members can take a shower a day? Round to the nearest whole number.  
**Answer: 6 crew members.**
- How many days would it take for the entire 80 member crew to take a shower? Round to the nearest whole number. **Answer: 13 days.**

## Science

Have students complete the following experiment so students will understand how boats float.

Materials Needed:

- toy boat
- modeling clay
- bucket filled with water
- nuts
- bar of soap
- fruit
- vegetables
- paper clips
- jar lids

Experiment:

1. Teacher should place the toy boat in the water bucket of water.

2. Discussion. Ask students what the boat is doing? Answer: It is floating. Why does the toy boat float? Answer: The boat pushes down on the water and the water pushes back up. When the water pushes up as hard as the boat pushes down, then the boat floats. Ask the students if they can guess what would happen if the boat pushed down more than the water pushed up? Answer: The boat would sink.
3. Teacher should give each student the “Can it Float?” worksheet. Then allow students to observe the following objects in the water. Students should say whether the object sinks or floats.
4. One by one place the following objects in the water: nut, soap, fruit, vegetable, paper clip, jar lid, and ball of modeling clay.
5. Discussion. Since changing an object’s shape or weight can change whether it sinks or floats ask students what could be done to keep the clay ball from sinking.
6. Have students make different shapes with the clay and figure out which ones float and which ones sink.
7. On the back of the worksheet have students draw the successful shapes that floated.

Observations:

- What causes objects in water to float? Is it the shape, the weight, or both?

**Build a Submarine Activity:** Have students work in groups to create a submarine. This activity will allow the students to understand how a submarine can submerge and resurface without sinking.

Materials Needed:

- 2 liter bottle
- 24 pennies
- Foil
- 3 rubber bands
- bendy straw
- tape
- bucket filled with water

Instructions:

1. Cut a hole in the bottle’s cap and three holes into the side of the soda bottle (NOTE: make sure they are in a straight line).
2. Stack the pennies into three piles containing 4, 8, and 12 pennies.
3. Carefully wrap the stacks of pennies in foil.

4. Place one of the rubber bands around the plastic bottle and slide it next to the closest hole. Position the other rubber bands next to the two remaining holes.
5. Place the smallest penny stack under the rubber band closest to the bottle's top (NOTE: the stacks of pennies and rubber bands should be beside the holes not covering them).
6. Place the middle penny stack under the middle rubber band, next to the middle hole.
7. Place the largest penny stack under the last rubber band.
8. Push the shorter end of the straw through the hole in the bottle's cap. Reattach the bottle cap to the bottle. Keep the flex section outside and bent upwards. Tape the straw securely into place.
9. Lower the submarine into the water. Make sure the straw is bent upwards out of the water.
10. Observe the action of the submarine and record your observations.
11. When the submarine stops, blow into the straw.
12. Observe the action of the submarine and record your observations.
13. Conduct a class discussion.

Observations:

- What made the submarine go under the water? What made it surface? Display to the class "Diagram of a Submerging Submarine." This diagram shows what causes a submarine to submerge.
- What is your model missing that the U.S. Navy submarines have to keep the crew members safe? **Answer: Ballast Tanks.**
- What do submarines have to navigate themselves? **Answer: Dive Planes (Bow and Stern) to move the submarine up and down. Rudder to move the submarine left and right. Periscope to see above the water. SONAR to see below the water. Maps and a Gyro Compass to navigate.**

To extend the activity have each group to research the different tools used to navigate a submarine.

## Geography

Display a United States map and give students a blank map. Write the following locations on the board:

Baltimore, Maryland  
 Buffalo, New York  
 Charleston, South Carolina  
 Chicago, Illinois  
 Cleveland, Ohio

Muskegon, Michigan  
 Muskogee, Oklahoma  
 New York, New York  
 North Little Rock, Arkansas  
 Omaha, Nebraska



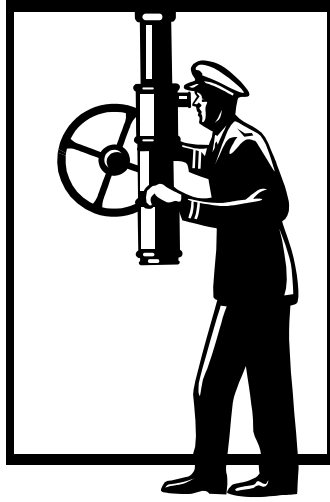
Fall River, Massachusetts  
Galveston, Texas  
Groton, Connecticut  
Hackensack, New Jersey  
Honolulu, Hawaii  
Long Beach, California  
Manitowoc, Wisconsin  
Mobile, Alabama

Patterson, New Jersey  
Philadelphia, Pennsylvania  
Pittsburgh, Pennsylvania  
Portland, Oregon  
Portsmouth, New Hampshire  
San Diego, California  
San Francisco, California  
Sea Girt, New Jersey

It would be best if students work in small groups so that one student can locate the city on the United State map on display, one student can label the states, and the other student can fill in the cities. Explain to the students that the cities they found are locations where submarines are on display for people to visit and tour.

- How many states have submarines on display? **Answer: 20 states.**
- How many cities have submarines on display? **Answer: 26 cities.**
- If there are 28 Naval submarines on display in the United States and no city had three submarines on display, how many cities have multiple submarines on display? **Answer: 2 cities. These cities are Charleston, South Carolina, and San Diego, California.**
- If there are 24 United States Naval submarines on display, what could the other four submarines be? **Answer: Confederate, German, and two Russian.**

## Sixth through Eighth Grade



### English Language Arts

In groups students can create anchor charts about the technology used on submarines. Each group should be given one of the following: Gyro Compass, Sonar, Radar, Periscope, Depth Gage, Morse Code Machine, and Snorkel System. Each group should be able to answer the following questions:

- What does it do?
- Who made it?
- Where did it come from?
- What is it made of?
- How big is it?

Have students write a creative writing prompt “What if” about a historical event that a submarine was involved in. Have students visit the website [www.aimm.museum](http://www.aimm.museum) to look at photographs, read oral histories, and read primary source documents. Students can learn about other submarines as well.

### Math

Have students complete the math problems to understand how many submarines are on “eternal patrol.”

- If 292 submarines were built in World War II and 52 submarines were “lost,” what is the percentage of “lost boats” during World War II? **Answer: 18%.**

- The United States Navy has built 658 submarines since 1861. Since 1861, the United States has lost 65 submarines total. What is the percentage of “lost boats” for the United States Navy? **Answer: 10%.**

Have students make a bar graph about loss of life on submarines during World War II by year 1941-1945.

- 1941: **1**
- 1942: **7**
- 1943: **17**
- 1944: **19**
- 1945: **8**

After making the chart have the students answer the following questions.

- What year saw the most submarines lost? **Answer: 1944 with 19 submarines lost.**
- What year saw the least submarine lost? **Answer: 1941 with 1 submarine lost.**

Have students complete the following math problems to learn about supply and demand with oxygen on a submarine. Submarines during World War II had a limited amount of oxygen. Why is oxygen needed? Oxygen is needed for humans to breathe. Have students complete the math problems to figure out how long the submarine could stay under the water and still have oxygen.

- If a human uses 19 cubic feet of oxygen in 24 hours and there are 80 crew members on a submarine, how many liters of oxygen needs to be available on a submarine for 24 hours? **Answer: 1,520 cubic feet.**
- If there is 2,320 cubic feet of oxygen on a submarine how long can the submarine stay submerged? **Answer: 36 hours.**

To get more oxygen the submarine has to surface.

## Science

Have students complete the following science experiment to understand propulsion that is used by engines to move vehicles. Students will build a car in groups. A car is being built because it is too expensive to build a submarine that can float in water to show propulsion.

Materials Needed:

- 1 pint milk carton per group
- Cardboard
- balloons (long, thin)

- straws
- scissors
- table
- masking tape
- rulers

#### Preparation:

1. Punch four “axle” holes in the milk cartons. Holes should allow straws (axles) to turn easily.
2. Punch a fifth straw hole in the back of the carton.
3. Blow up balloons and let them deflate.
4. Insert a straw one inch into the nick of each balloon. Secure the straw with tape or a rubber band.

#### Experiment:

1. Distribute material and “Propulsion Power” worksheet.
2. Help kids cut holes in the middle of wheels.
3. Demonstrate how to blow up a balloon through a straw.
4. After students have assembled cars, let them test “engines” on an uncarpeted floor.
5. Have students write the distance traveled by the car on their “Propulsion Power” worksheet.
6. Discussion: What’s causing the bus to move? **Answer: Air, forced out of the balloon, propels the balloon – which pushes the bus.** What else is moved by propulsion? **Answer: Rockets, jets, submarines.**
7. Have students try the experiment again with the balloons blown up more.
8. Have students try the experiment again with the balloons blown up less.
9. Have students write down their observations.

A gas-powered engine combines gasoline, air, and a spark to produce a small, strong explosion. Cars have tanks where gas is stored. A pump inside the bus or car pulls gas through pipes and hoses to the carburetor. There, air mixes with gas. That mixture is pulled into the cylinder. There, a spark makes the gas-air mixture explode.

The car’s propulsion is caused by the engine connected to the wheel axels. The rotation of the wheels moves the car. In a submarine, propulsion is caused by an electric motor that turns the propellers. The rotation of the propellers moves the submarine.

## Geography

Display a United States map and gives students a blank map. Write the following locations on the board:

Baltimore, Maryland  
Buffalo, New York  
Charleston, South Carolina  
Chicago, Illinois  
Cleveland, Ohio  
Fall River, Massachusetts  
Galveston, Texas  
Groton, Connecticut  
Hackensack, New Jersey  
Honolulu, Hawaii  
Long Beach, California  
Manitowoc, Wisconsin  
Mobile, Alabama

Muskegon, Michigan  
Muskogee, Oklahoma  
New York, New York  
North Little Rock, Arkansas  
Omaha, Nebraska  
Patterson, New Jersey  
Philadelphia, Pennsylvania  
Pittsburgh, Pennsylvania  
Portland, Oregon  
Portsmouth, New Hampshire  
San Diego, California  
San Francisco, California  
Sea Girt, New Jersey

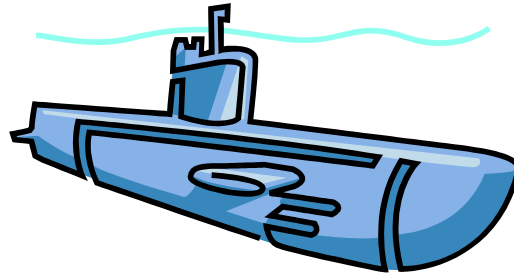
It would be best if students work in small groups so that one student can locate the city on the United State map on display, one student can label the states, and the other student can fill in the cities. Explain to the students that the cities they found are locations where submarines are on display for people to visit and tour.

- How many states have submarines on display? **Answer: 20 states.**
- How many cities have submarines on display? **Answer: 26 cities.**
- If there are 28 Naval submarines on display in the United States and no city had three submarines on display, how many cities have multiple submarines on display? **Answer: 2 cities.**
- These cities are Charleston, South Carolina, and San Diego, California. If there are 24 United States Naval submarines on display, what could the other four submarines be? **Answer: Confederate, German, and two Russian.**

After your class has visited the museum, allow students to look up the different submarines on display around the United States. Have the students create a road trip where they would visit four of the submarines. During their planning students need to figure out how many miles they will drive, how many days their trip will take, and create a driving itinerary. Students can only drive 70 miles an hour on interstates and 55 miles on highways. Students can only drive/visit submarines for 15 hours a day. Students have to spend at least one hour at each submarine on display. The driving itinerary should state their starting location, the route to get to each location including highways and interstates that will be used, how many miles they will be on each road, and their ending location (which should be the same as their starting location). When students

change roads students must use cardinal directions. Students should write a short paragraph of why they chose the submarines they chose to visit. This activity can be completed in class or at home.

## *Ninth through Twelfth Grade*



### **English Language Arts**

Allow students to learn the evolution of submarines by creating an exhibit about different classes of submarines that were used by the United States Navy. Educators should use the National History Day guidelines on creating an exhibit. The exhibit should present the story of the submarine class. The exhibit should explain the following information: years the class was built, the number of submarines that were built in that class, events the class was used in, places they served in the world, and their main purpose. The exhibit should also highlight one of the submarines from the class. Resources that can be used are primary source documents, images, objects that are from or would be used on the submarine class, and secondary source documents.

Exhibits are three dimensional visuals that represent each group's research and interpretation of the topic's significance in history. The analysis and interpretation of the topic must be clear and evident to the viewers. The use of images, documents, objects, and graphics should enhance the message of your exhibit. Exhibits can be interactive by including music, puzzles to solve, videos to watch, and moving parts to reveal more documents, images, or answers to questions. The language in the exhibit needs to be grammatically correct, use of good sentence structure, wise word choices, and contain no spelling errors. Exhibit labels should be brief, so the ideas need to be clear and concise. Citations should be included on the exhibit.

Size requirements: The overall size of the exhibit should be no larger than 40 inches wide, 30 inches deep, and 6 feet high. Most people use a tri-fold display board. Media Devices: Media must run no longer than 3 minutes. Viewers must be able to control media devices. Word Limit: There is a 500-word limit for the exhibit. All words that are written by the group is counted. Documents and citations are not counted. Dates count as one word.

## Research Topics

<b>Class</b>	<b>Years Built</b>	<b>Number Built</b>	<b>Interesting Fact(s)</b>	<b>Suggested Submarine to Highlight</b>
Alligator	1861-1862	1	First submarine in the U.S. Navy. Served during the Civil War.	USS <i>Alligator</i>
Holland	1896-1900	1	First submarine commissioned into the U.S. Navy. Named after inventor John Philip Holland. On display in New Jersey.	USS <i>Holland</i>
Gato	1940-1944	77	Used during World War II. Six submarines on display in the United States.	USS <i>Drum</i>
Balao	1942-1948	128	Major submarine used during World War II. Eight submarines on display in the United States.	USS <i>Batfish</i>
Tench	1944-1951	29	Three submarines on display in the United States.	USS <i>Torsk</i> or USS <i>Requin</i>
Thresher/Permit	1958-1968	14	Class name changed when USS Thresher sunk. Thresher was the first United States nuclear submarine to sink.	USS <i>Thresher</i>
Los Angeles	1972-1996	62	Currently used nuclear submarines.	USS <i>Los Angeles</i> or USS <i>Dallas</i>
Ohio	1976-1997	18	Currently used nuclear submarines.	USS <i>Ohio</i>
Seawolf	1989-2005	3	Currently used nuclear submarines.	USS <i>Seawolf</i>
GUPPY IIA	1952-1954	17	Program to modernize older submarines. USS <i>Razorback</i> on display in Arkansas.	USS <i>Razorback</i>
<i>Turtle</i>	1776		First submarine warship in the world, used during the Revolutionary War by the United States.	<i>Turtle</i>
CSS <i>Hunley</i>	1863-1864		First successful submarine to sink an enemy vessel in the world. Confederate submarine used during the Civil War. On display in South Carolina.	CSS <i>Hunley</i>



## Math

Have students complete the following math problems to figure out a diesel submarine's miles per gallon compared to a diesel semi-truck. The equation to figure out a vehicle's miles per gallon is Mileage B minus Mileage A. Divide the mileage number by the number of gallons held in the gas tank equals the miles per gallon.

- If a diesel semi-truck drives 980 miles on 150 gallons of diesel fuel what is the miles per gallon? **Answer: 6.5 miles per gallon.**
- If a diesel submarine can travel 20,000 miles on 118,000 gallons of diesel fuel what is the miles per gallon? **Answer: 0.17 miles per gallon.**

## Geography

Write the word "World Ocean" on the board. Have on display to students a globe or world map. Ask students if there is more land or water? **Answer: 71% of the surface of the earth is covered in salt water.** The world ocean is divided into six major ocean basins. Have students discuss what these six major ocean basins are. **Answer: South Pacific, North Pacific, Indian, North Atlantic, South Atlantic, and Arctic (listed in order of size).** Identify these areas on the globe or map. Within the ocean basins there are "seas." The important seas due to location and natural resources include: **Mediterranean Sea, Caribbean Sea, North Sea, Baltic Sea, Black Sea, Red Sea, Arabian Sea, South China Sea, Sea of Japan, Barents Sea, and Bering Sea.** Locate the seas on the globe or map. "Gulfs" are pockets of seas that reach into the continents. Locate the following gulfs and state what continent it reaches: **Gulf of Mexico/North American, Persian Gulf/Asia, and Gulf of Aden/Africa.**

Give students different sources about USS *Scorpion* which details the facts and theories of the sinking of the last United States nuclear submarine. Have students write what they think happened to the submarine based on the information that they read.

## Appendix



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# “Diagram of a Submarine”

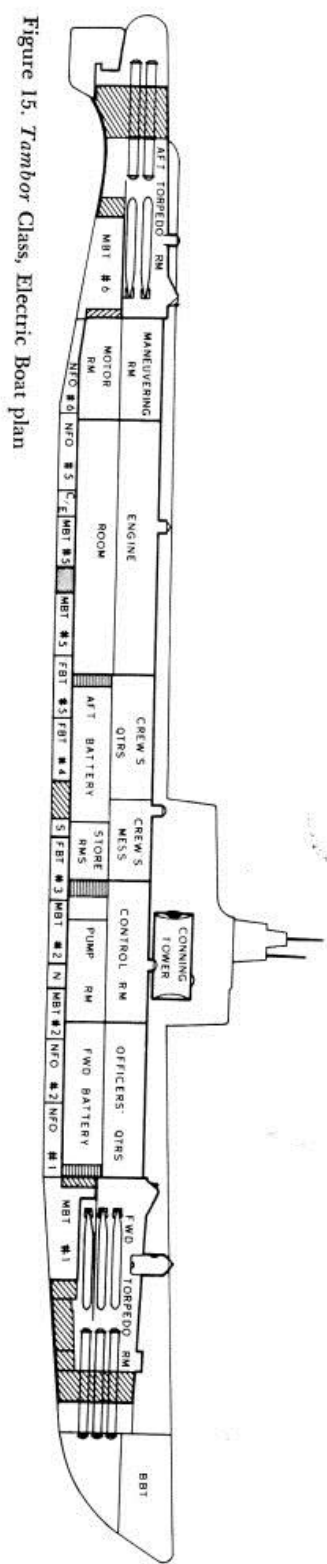
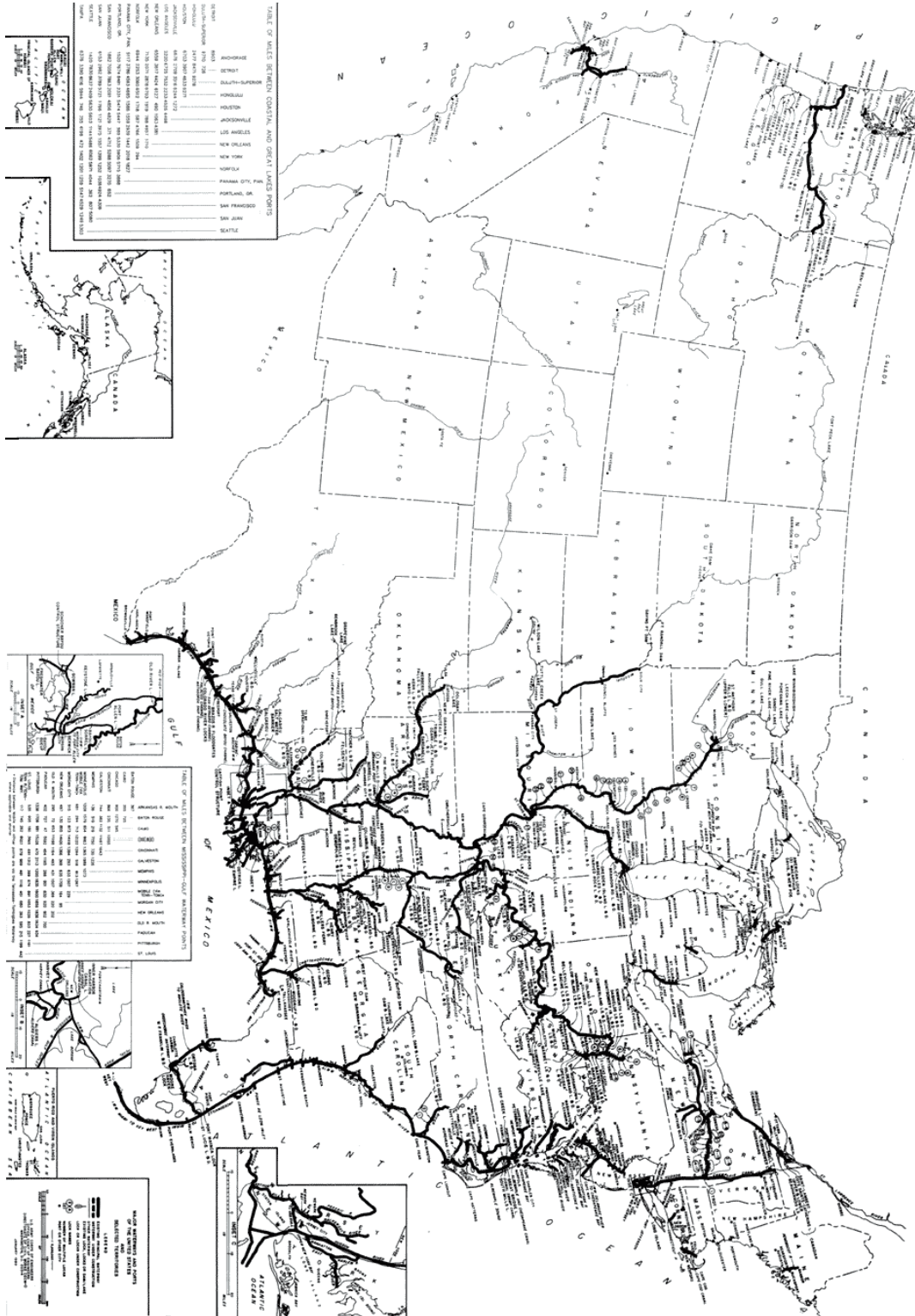


Figure 15. *Tambor* Class, Electric Boat plan

# “United States Inland Waterways”



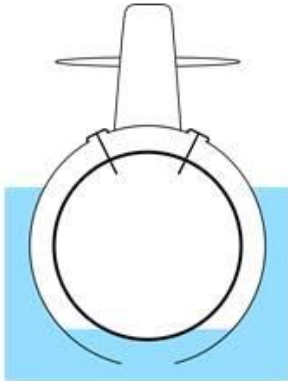


## “Can it Float?”

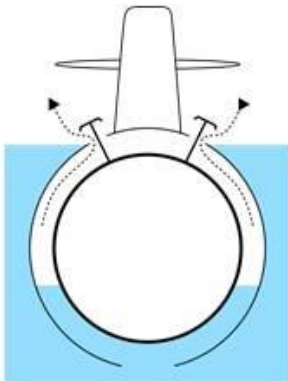
<b>Object</b>	<b>Observation</b>	<b>Float or Sink</b>
Nut		
Soap		
Fruit		
Vegetable		
Paper Clip		
Jar Lid		
Clay Ball		



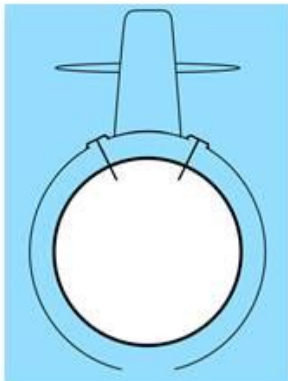
## “Diagram of a Submerging Submarine”



A submarine begins floating on the surface of the water. The inner circle represents the inner hull of the submarine. This hull on USS Razorback is 7/8” thick. The space between the inner hull and outer hull represents the ballast tanks.



The ballast tanks are used to allow the submarine to stay on the surface or to submerge. The arrows at the top show that vents are opened by levers to allow the air to escape. Once the air pressure has changed the water enters the tanks.



The water in the ballast tanks causes the submarine to submerge because the submarine becomes heavier than the water that would occupy that area.



## “Propulsion Power”

### Materials Needed:

- Milk Carton
- Cardboard
- Balloon (long, thin)
- Straw
- Scissors
- Table
- Masking tape
- Ruler

Some cars move with gasoline power. Can you move your own car with balloon power?

### Make Your Car:

1. Cut the top of your milk carton.
2. Cut out four round cardboard wheels with 2 inch diameter.
3. Use a pencil to punch holes in the middle of your wheels.
4. Push the straws through the holes in the milk carton. They should stick out on each side.
5. Tape the wheels onto the ends of the straws.
6. Slide the straw with the balloon into the hole in the back of the milk carton.

### Make Your Car Move:

1. Blow up your balloon partway.
2. Pinch the end of the straw to keep the air in.
3. Put the bus down and let go of the straw.

A gas-powered engine combines gasoline, air, and a spark to produce a small, strong explosion. Cars have tanks where gas is stored. A pump inside the bus or car pulls gas through pipes and hoses to the carburetor. There, air mixes with gas. That mixture is pulled into the cylinder. There, a spark makes the gas-air mixture explode.

## “USS Scorpion Sources”

The following resources tell the history of the sinking of USS *Scorpion*. USS *Scorpion* was the last United States submarine lost in 1968. These sources also detail the different theories of how the submarine was lost. The sinking of the submarine does have an Arkansas tie, due to a Parkview graduate from 1965 was aboard when the submarine went down. A memorial to this sailor is located at the Arkansas Inland Maritime Museum.

- *History of USS Scorpion (SSN-589)*
- *Experts Out to Solve Deep-sea Mystery of the USS Scorpion*
- *The USS Scorpion Buried at Sea*



## History of USS Scorpion (SSN-589)

*Written by Naval History and Heritage*

*30 July 2001*

The sixth Scorpion (SSN-589) was laid down on 20 August 1958 by the Electric Boat Division, General Dynamics Corp., Groton, Conn.; launched on 19 December 1959; sponsored by Mrs. Elizabeth S. Morrison; and commissioned on 29 July 1960, Comdr. Norman B. Bessac in command.

Assigned to Submarine Squadron 6, Division 62, Scorpion departed New London, Conn., on 24 August for a two-month deployment in European waters. During that period, she participated in exercises with units of the 6th Fleet and of other NATO [North Atlantic Treaty Organization] navies. After returning to New England in late October, she trained along the eastern seaboard until May 1961, then crossed the Atlantic again for operations which took her into the summer. On 9 August, she returned to New London and, a month later, shifted to Norfolk, Va.

With Norfolk her home port for the remainder of her career, Scorpion specialized in the development of nuclear submarine warfare tactics. Varying her role from hunter to hunted, she participated in exercises which ranged along the Atlantic coast and in the Bermuda and Puerto Rican operating areas; then, from June 1963 to May 1964, she interrupted her operations for an overhaul at Charleston, S.C. Resuming duty off the eastern seaboard in late spring, she again interrupted that duty from 4 August to 8 October to make a transatlantic patrol. In the spring of 1965, she conducted a similar patrol in European waters.

During the late winter and early spring of 1966, and again in the fall, she was deployed for special operations. Following the completion of those assignments, her commanding officer received the Navy Commendation Medal for outstanding leadership, foresight, and professional skill. Other Scorpion officers and men were cited for meritorious achievement.

On 1 February 1967, Scorpion entered the Norfolk Naval Shipyard for another extended overhaul. In late October, she commenced refresher training and weapons system acceptance tests. Following type training out of Norfolk, she got underway on 15 February 1968 for a Mediterranean deployment. She operated with the 6th Fleet, into May, and then headed west for home. On 21 May, she indicated her position to be about 50 miles south of the Azores. Six days later, she was reported overdue at Norfolk.

A search was initiated, but, on 5 June, Scorpion and her crew were declared "presumed lost." Her name was struck from the Navy list on 30 June.

The search continued, however; and, at the end of October, the Navy's oceanographic research ship, Mizar (T-AGOR-11) located sections of Scorpion's hull in more than 10,000 feet of water about 400 miles southwest of the Azores. Subsequently, the Court of Inquiry was reconvened and other vessels, including the submersible Trieste were dispatched to the scene and collected a myriad of pictures and other data.

Although the cause of her loss is still not ascertainable, the most probable event was the inadvertent activation of the battery of a Mark 37 torpedo during a torpedo inspection. The torpedo, in a fully ready condition and without a propeller guard, then began a live "hot run" within the tube. Released from the tube, the torpedo became fully armed and successfully engaged its nearest target, Scorpion. Alternatively, the torpedo may have exploded in the tube owing to an uncontrollable fire in the torpedo room.

The explosion--recorded elsewhere as a very loud acoustic event--broke the boat into two major pieces, with the forward hull section, including the torpedo room and most of the operations compartment, creating one impact trench while the aft section, including the reactor compartment and engine room, created a second impact trench. The sail is detached and lies nearby in a large debris field.

Owing to the pressurized-water nuclear reactor in the engine room, deep ocean radiological monitoring operations were conducted in August and September 1986. The site had been previously monitored in 1968 and 1979 and none of the samples obtained showed any evidence of release of radioactivity.

## Experts Out to Solve Deep-sea Mystery of the USS Scorpion

*Written by Dan Verano from USA Today*

The sub has been inspected by undersea recovery teams, including a visit in 1985 by oceanographer Robert Ballard before his team's discovery of the Titanic shipwreck.

The cause of the sub's loss remains hotly disputed. A Navy Court of Inquiry found "the cause of the loss cannot be definitively ascertained."

Evidence for a more mundane explanation comes from the sub's propeller shaft, Boyne says. Undersea photographs show it rests about 20 yards outside the wreck on the seafloor, about 11,220 feet underwater. Boyne suggests that rubber bearings holding the propeller shaft failed, putting stress on the coupling connecting it to the engine. The coupling's bolts failed catastrophically during a deep test dive, the theory goes, spilling water into the sub too rapidly to allow ballast maneuvers to raise the ship to the surface.

"What happened to the Scorpion isn't so much a mystery, as a secret," says Ed Offley, author of *Scorpion Down: Sunk by the Soviets, Buried by the Pentagon*, which argues for the covert Soviet sub attack explanation.

Investigators who start from technical documents related to the ship's loss, typically differ with his interpretation, he says, which was based on interviews with Navy personnel.

"It couldn't hurt to have a documented expedition to Scorpion," says Offley, who is not a member of the proposed expedition team.

## The USS Scorpion Buried at Sea

*Written by Ed Offley from the MHQ magazine*

*August 26, 2009*

The crisis exploded without warning across the sprawling U.S. Navy community in Norfolk, Virginia: A nuclear submarine and its crew had vanished in the Atlantic. On May 27, 1968, USS Scorpion (SSN 598) failed to return as scheduled to its home port at the destroyer-submarine pier complex at the southern end of the waterfront.

Within hours the sub's failure to arrive escalated into a major military crisis that spread to the Pentagon E-Ring and White House. From Atlantic Fleet headquarters to dozens of homes and apartments across Hampton Roads, a day of anticipation and celebration had suddenly turned into an open-ended vigil of fear and uncertainty.

Scorpion and its 99-man crew had left Norfolk on February 15 for a three-month Mediterranean deployment. The crew participated in several naval exercises with the U.S. Sixth Fleet and NATO, conducted ongoing reconnaissance of Soviet naval units in the Med, and paused to enjoy liberty at ports in Italy and Sicily before reentering the Atlantic for the homeward voyage on May 17. Scorpion's skipper, Commander Francis A. Slattery, had radioed Atlantic Submarine Force headquarters early on May 22 that the sub would arrive in Norfolk at 1 p.m. the following Monday, Memorial Day. Officials had released the arrival date 72 hours earlier and, despite a spring nor'easter that had swept the navy base with high winds and heavy rain, family members and Submarine Squadron 6 officials anticipated seeing the low silhouette of the Skipjack-class submarine coming into view on time.

The 1 p.m. arrival time came and went with no sign of Scorpion. Unknown to the families of the crew, the submarine's failure to break radio silence by late morning had already sparked concern that by early afternoon was swelling into near panic throughout the Atlantic Submarine Force headquarters staff. At 3:15 p.m. the navy made it official, transmitting a flash message over the Fleet Broadcast System to naval bases from Brunswick, Maine, to Jacksonville, Florida, and out to Bermuda, the Azores, and the Mediterranean. Its terse technical phrases meant only one thing: Scorpion was missing:

Executed Event SUBMISS at 271915Z for USS Scorpion ETA NORVA 271700Z....All submarine units surface or remain surfaced until this message cancelled. Units in port prepare to get underway on one hour's notice....

The curtain opened on what a navy admiral involved in the Scorpion incident would later describe as "one of the greatest unsolved sea mysteries of our era." The 251-foot-long submarine and its crew had inexplicably disappeared somewhere in the trackless Atlantic Ocean. For four decades, the navy and U.S. intelligence communities have

revealed little about the facts of the Scorpion sinking, citing the need to protect military secrets. The full account of its loss has continued to elude and frustrate researchers, journalists, and family members of the 99 sailors who died aboard the sub. But a careful reexamination of the public record—as well as interviews with former U.S. and Soviet military officials, men involved in the search for the sub, and sailors stationed on Polaris missile submarines on patrol in 1968—suggests the sinking may not have been an accident. Instead, it may have been the outcome of a deadly Cold War confrontation between the U.S. and the Soviet Union that both sides chose to bury at the bottom of the sea.

As documented in press accounts, U.S. Navy situation reports, and the official court of inquiry convened to probe the incident, by nightfall on that Memorial Day, Atlantic Fleet commander Admiral Ephraim P. Holmes had ordered what would become the largest U.S. naval operation since the Cuban Missile Crisis six years earlier. Officials announced that Vice Admiral Arnold F. Schade, the Atlantic Submarine Force commander, was out at sea in the Atlantic in the Connecticut-based nuclear attack submarine USS Pargo (SSN 650), and had directed it to head south at full speed for the Virginia Capes to organize a search of the shallow waters off the East Coast.

Meanwhile, the first members of what would become a task force of nearly sixty ships and submarines and dozens of land-based patrol aircraft raced into the Atlantic that Monday night to search for the missing sub. For nine days the searchers scoured the ocean from the continental shelf to the Azores, looking for any sign of Scorpion. They failed to find a single clue. Nine days later, on June 5, Admiral Thomas H. Moorer, chief of naval operations, declared that both submarine and crew were "presumed lost."

Throughout June and July 1968, two Scorpion investigations proceeded on parallel paths. A small group of scientific research and support ships headed by the oceanographic research vessel USNS Mizar (T-AGOR 11) scoured an "area of special interest" southwest of the Azores that scientists had identified by examining underwater signals that they believed came from the submarine's sinking at 1844Z (GMT) on Wednesday, May 22.

In Norfolk a seven-member court of inquiry convened on June 5 to probe Scorpion's disappearance. In his message appointing retired Vice Admiral Bernard L. Austin president of the Scorpion investigation, Admiral Holmes set out the inquest's mission: "The Court is directed to inquire into all the facts and circumstances connected with the disappearance of the Scorpion; death of, or injuries to personnel aboard...and to fix responsibility for the incident. After deliberation, the Court shall submit its findings of fact, opinions and recommendations."

The seven-member panel had legal powers equivalent to those of a civilian grand jury, and the authority to review classified information up to the level of top secret. Its mandate did not include determining criminal guilt or innocence. The court's chief function was to determine the facts. During eleven weeks of hearings—most of them closed to the press and public due to the classified information under examination—the court took sworn testimony from ninety witnesses and reviewed 232 separate exhibits.

By mid-August, the court had scoured the submarine's operational and administrative history, reviewed detailed records of its two shipyard overhaul periods since joining the fleet in 1960, examined what records were available on the Mediterranean deployment, and received updates on Mizar's ongoing "technical" search in the eastern Atlantic. After huddling for two weeks, the panel completed an initial report of over eighteen hundred pages—classified top secret at the time—that Admiral Austin submitted to the navy's uniformed leadership for review.

Two months later came stunning news: On October 30, 1968, the navy announced that Mizar had found the wreckage of Scorpion. A towed sled gliding fifteen feet above the ocean floor at the end of a three-mile cable had photographed the sub's broken hull. Several thousand images of the site were rushed back to the United States, where the hastily reconvened court of inquiry met with navy photo analysts to see if the new evidence might lead them to a firm conclusion as to what had caused Scorpion's destruction.

On January 31, 1969, the navy tersely announced an unclassified summary of the court's findings. In effect, Admiral Austin and his fellow panelists had thrown up their hands. Their conclusion: "The certain cause of the loss of Scorpion cannot be ascertained by any evidence now available." For the Scorpion families and many navy personnel, the court's findings were a major disappointment. The court did rule out foul play, an underwater collision with an undersea mountain, and a reactor malfunction, and expressed confidence in the crew's training, the submarine's overall material condition, and the safety of its torpedoes. By implication, the court let stand an unstated premise that some unconfirmed mechanical malfunction had sent the submarine plunging to the Atlantic abyssal plain two miles down.

For fifteen years afterward, that was the extent of what the navy, submarine service, Scorpion families, and the public knew about what had happened to the sub and its crew. Citing the operational requirements of the nuclear submarine force and the sensitivity of all information on the Skipjack-class submarine's capabilities, the navy kept the Scorpion archive locked away in a top-secret vault.

However, when I talked with Admiral Schade, the retired Atlantic Submarine Force commander, fifteen years after Scorpion's mysterious demise, he lifted a corner of the

navy's opaque security cloak that had long concealed most details of the incident. In an interview for a fifteenth-anniversary retrospective article on the tragedy, Schade offered up details of events in May 1968 that contradicted the official account of the sub's disappearance.

Despite the many unknowns that still kept the Scorpion narrative incomplete, on one key point U.S. Navy officials, reporters, ordinary sailors, and family members had all agreed: The crisis had flared up suddenly—on that May 27, after Scorpion's 1 p.m. arrival time passed with no sign of the submarine. Slattery had announced the arrival date and time in an encrypted message to Atlantic Submarine Force headquarters composed late on May 21.

Officials briefing reporters in the hectic first days of the Scorpion search had related the sub's last known position as 29:19 north 27:37 west, about 400 miles southwest of the Azores. The message, officials said, also included Slattery's homeward course track. Admiral Schade and other staff officers who appeared before the court of inquiry said the same thing: The crisis had begun on May 27.

Captain Wallace A. Greene, who as Submarine Division 62 commander in 1968 was responsible for Scorpion and three other nuclear attack boats, remained adamant on that point many years later: "There was no reason for us to have been the slightest concerned for her safety." Schade himself had flown to Connecticut earlier that Monday morning for the ride on Pargo.

A second premise on which all officials agreed was that Scorpion had been operating under radio silence following the transmission of the May 21 message, a common practice for submarines at sea. This explained why there was no concern in Schade's headquarters in Norfolk over the lack of messages from the submarine during the five-day period between the actual sinking on May 22 and its scheduled arrival on Memorial Day. In his own testimony to the court of inquiry on June 5, Schade mini-mized the significance of his command's lack of awareness that anything had happened to Scorpion: "Polaris subs go on 60-day patrol and never broadcast," he explained to the court.

But when he talked with me in April 1983, Schade revealed that Scorpion's radio silence had in fact been a cause for concern. He disclosed that the Atlantic Fleet had actually launched a highly classified search for Scorpion sometime shortly after May 22. When pressed, he said the submarine's failure to respond to a message from his headquarters prompted the alert. "We got that position report," Schade said of the May 21 Scorpion message. "That was the basis for our initial search operation. But that was really all we had and we didn't consider that too significant, other than just as the last known position that we actually had. They were due to report in to us shortly thereafter. It was at that



time we got a little suspicious, because they did not report, they did not check in, and then, when we got to the time limit of their 'check-in,' they were first reported as overdue."

Pressed on this point, Schade elaborated: "As far as we were concerned, all was clear and she should have kept coming and then within about 24 hours after that she should have given us a rather long, windy resume of her operations and what she would need upon her return to port...you know, transition from one command to another, homeward-bound voyage. We have absolute confidence in our communications, both in the reception and the response and when they did not respond, almost immediately that's when we first became suspicious, that's when we followed up with other messages, and really, it was just a matter of hours that we became somewhat concerned."

Realizing that no one's memory is perfect, it was not unreasonable to surmise that fifteen years after the event, Schade's recollections might have been incomplete or inaccurate. But then the old submariner made another surprising revelation: "I happened to be out at sea in the Ray [SSN 653], which was the..."

Q: (Referring to press reports that Schade had been aboard the Groton-based Pargo on the morning of May 27): "Was this off Connecticut?"

A: "No, I was out at sea off Norfolk in the Ray, which was the flagship of the [Atlantic] Submarine Force, and when we first got the report and it looked like we needed to do something in the way of a search operation, I got Admiral Holmes on the radio and said, 'Would you place the facilities of CINCLANTFLT [commander in chief, Atlantic Fleet] at my disposal for the next day or two until we can organize a search operation?'"

Q: "Was this before May 27?"

A: "I can't remember the dates. As soon as we were concerned that she had not checked in."

Q: "SUBMISS was declared several hours after the Scorpion's arrival time on 27 May. Was this before..."

A: "No—well before her scheduled arrival because we worked back from Norfolk all the way to her last reported position, which was in the neighborhood of the Azores."

Q: "Prior to the day she was supposed to get back you had already asked CINCLANTFLT if he could put some resources at your disposal?"

A: "Well in advance of that. And in fact, he had placed them all at our disposal and this was quite an amazing set of operational circumstances because we controlled the entire



resources of the Atlantic Fleet from a submarine at sea. Working through CINCLANTFLT headquarters and their communications, but we organized a search from both ends—both by air and surface ships and other submarines."

Q: "The [newspaper] clips don't tell all of the story. You're saying that you were looking for Scorpion before the 27th of May?"

A: "All I know is that long before she was actually due in Norfolk we had organized a search effort. We had two squadrons of destroyers, a lot of long-range antisubmarine search planes operating out of the Azores, Norfolk, and other areas, and we had several ships that were in the Atlantic that were in transit between the Med and the U.S. Some [were] diverted [and] some of them were just told to come over to the track which we presupposed the Scorpion would be on. They searched up and down that. This went on for quite some time, until it was quite obvious that she was long overdue arriving in Norfolk."

Q: "But you kept this on a classified basis?"

A: "Well, it was classified more because we didn't know where she was or what had happened and we were just trying to find out. It was no sense making a big brouhaha over something we really couldn't explain."

The admiral's revelations suggested that there was a lot more to the story of what had happened to Scorpion than the navy had publicly revealed. Moreover, it became apparent that winnowing out the actual Scorpion story from the official account would take more than a recitation of known facts and newly released details.

To begin with, a veil of secrecy surrounded Scorpion's final operational assignment before it sank on May 22. Shortly after reentering the Atlantic, Schade diverted Scorpion nearly twelve hundred miles south of its homeward track to conduct surveillance on a group of Soviet warships—including at least one nuclear submarine—operating near the Canary Islands off the northwest coast of Africa. The court of inquiry noted the presence of the Soviet ships but was silent on whether or not Scorpion had conducted any surveillance against them, noting only that the evidence it had reviewed showed no indication of hostile Soviet acts. Schade in 1983 told me he had indeed dispatched Commander Slattery to spy on the Soviets, but backpedaled on whether or not the mission had actually occurred. Navy officials and declassified documents paint contradictory conclusions, with some asserting that the mission took place and others denying it.

Nevertheless, the pre-May 27 search revealed by Schade remained a key for penetrating the navy's security cloak on the Scorpion incident. Two other senior admirals serving in 1968—Thomas A. Moorer and Philip A. Beshany—confirmed during

on-the-record interviews that the secret search had indeed taken place. Moreover, sailors on several Atlantic Fleet ships that participated in that classified hunt later provided compelling details of a sudden scramble to sea four days before May 27, so abrupt that in at least two instances it resulted in large numbers of the ships' crews being left behind.

The significance of the secret Scorpion search was pivotal to uncovering the details of what had really happened to the sub. Schade and Admiral Moorer, the chief of naval operations at the time, had both explained that the secret search effort was a precautionary step ordered after their concern had grown over the submarine's failure to respond to messages. They explained the navy's failure to subsequently reveal the existence of that search—even when Scorpion's disappearance could no longer be concealed after May 27—as an effort not to further upset the grief-stricken families.

That rationalization, however, failed to explain why Schade and others did not reveal the secret search to the court of inquiry charged with determining what had happened to Scorpion. To this day, the official navy line is that such a search never took place.

Troubling mysteries also surround the five-month span between the time the navy declared the submarine presumed lost on June 5 and the announced discovery of the wreckage two miles down in the eastern Atlantic on October 30. Responding to acoustic evidence, the "focused operations" search involving Mizar initially plotted an area about twelve miles by twelve miles wide in what was believed to be Scorpion's final resting spot, several hundred miles southwest of the Azores.

As the weeks turned into months, the ship doggedly dragged a sled mounted with strobe lights, cameras, magnetometers, and sonar transducers across the seabed in the search area. It was, one official later recalled, "like looking through a soda straw to find a lost contact lens in the front yard, at midnight in the rain." With little sign of progress, the tragedy eventually faded from the newspaper pages and public interest waned. Then, on October 30, came the stunning news: The navy announced that the searchers had located the lost sub's hull. Thousands of images of the torn hull photographed by Mizar's towed sled provided the navy with new evidence in its search for a cause of the sinking.

In retrospect, it appears that this dramatic five-month technical search for Scorpion was an elaborate charade. During a span of fourteen years (1993-2007), several dozen participants in the classified pre-May 27 search, the highly publicized open-ocean search-and-rescue mission, and the Mizar search have admitted that the navy actually knew where the Scorpion wreckage lay on the Atlantic seabed from the outset.

Numerous participants in the Scorpion search mission confirm that the navy actually located and photographed the submarine's wreckage nearly five months before Mizar's

"official" discovery on October 28. "We found that submarine...in the early part of June," said Bill Sebold, a crewman aboard Compass Island, a ship with advanced sonar capabilities that used multibeamed sounding instruments to create detailed contour maps of the deep-ocean floor. His account is echoed by several other crewmen on the ship, including Bill D'Emilio, who said unequivocally, "I was on board the Compass Island when we found the Scorpion."

Why did the navy not merely announce the discovery of the submarine when it actually occurred in early June 1968? One possibility is that the five-month Mizar search was carried out to make it appear that the submarine's loss was an accident and the searchers had no specific idea where it had gone down. That five-month timeline conformed to the known limitations in naval deep-ocean search technology at the time. With the same technology, it had taken the navy fourteen months to find the debris of the nuclear submarine USS Thresher (SSN 593) after it sank in April 1963—even though a submarine rescue ship was in voice contact with Thresher immediately before it sank and had a precise navigational fix on the location of that 1963 mishap.

With the Scorpion wreckage now officially found, the court of inquiry wrapped up its investigation, issuing a final report on January 31, 1969, concluding that even with the photographic evidence, the "certain cause" for the loss remained unknown. The court privately elaborated on that conclusion—in a secret section of its findings that would not be declassified and released for twenty-five years—that the most likely cause of the sinking was a runaway Mark 37 torpedo that was accidentally launched by Scorpion itself and turned on the submarine, homing in and striking it.

Skeptics offer an alternative explanation. They speculate that the sub had in fact been attacked and destroyed by a Soviet submarine in revenge, because Soviet officials believed that the U.S. Navy had been complicit in the sinking of the Golf II-class missile submarine K-129 in the Pacific on March 7, 1968. That was the sub that the CIA-financed ship Glomar Explorer attempted to lift off the Pacific seabed in the mid-1970s.

Support for this theory comes from the accounts of sailors at shore stations, on surface ships, and even aboard submerged missile submarines on patrol who have broken the official silence about the incident in recent years. They have disclosed that Scorpion had radioed Norfolk that it was being followed by a Soviet submarine and could not evade it—right before communications suddenly ended.

In face-to-face interviews, telephone calls, e-mails, and correspondence since 1998, dozens of former naval officers and enlisted men have provided new information about Scorpion's final days. Taken together, their testimonials depict a steadily growing crisis over Scorpion that began when the Norfolk-based sub reentered the Atlantic on May 17,

1968, and culminated in a confrontation five days later that left it at the bottom of the ocean.

Rear Admiral Philip A. Beshany, who was serving as director of submarine warfare on Moorer's staff when Scorpion suddenly disappeared, provided a critical piece of the puzzle that neither Admirals Schade nor Moorer had ever revealed: In all likelihood, the Scorpion surveillance mission against the Soviet warships off the Canary Islands had been blown.

"There was a lot of classified material relating to the Soviet group [circulating in the Pentagon at the time]," Beshany explained. "In fact, there was some concern that the Scorpion might have been trailed and sunk by them, that they had tracked our submarine and decided [it] had seen things they didn't want divulged....They had been alerted to the presence of Scorpion. They [U.S. intelligence and navy officials] had reason to believe at that time...that they might have detected her, trailed her and decided they would just eliminate her." Beshany said the information was at a level of classification so high that he and his colleagues would sometimes jest that it was a "burn before you read category."

Moreover, dozens of individuals who had been drawn into the Scorpion search at sea the week of May 20, 1968, provided explicit and repeated confirmation of Beshany's disclosure. When, at Schade's request, Admiral Holmes ordered surface ships and submarines to hunt for Scorpion during the week of May 20, his alert message included specific reference to the fact that the Soviets were trailing Scorpion. The message also said that the American sub had sent a message to Norfolk saying it was unable to elude its shadower. On surface ships, in subs, and in squadron ready rooms, sailors of all ranks and duties were aware of the ongoing encounter between Scorpion and the Soviet sub. Indeed, word that Scorpion had reported its inability to shake the Soviet submarine was so hot that it rocketed over the Navy Fleet Broadcast System to Polaris submarines on patrol. Two Polaris sub crewmen provided me with examples of the details of the ongoing Scorpion confrontation that they had learned as the crisis grew.

Ron Rule was a storekeeper on USS Nathanael Greene (SSBN 636), patrolling the North Atlantic during the week of May 20, when his commanding officer made an announcement over the ship's 1MC loudspeaker. "What I remember about the incident is the announcement over the 1MC that the Scorpion was missing. Obviously, this was a very sobering announcement, and it had an immediate effect on all of us," Rule recalled. "A very somber mood immediately came over all of us."

He remembered that the information the commanding officer relayed to Nathanael Greene's crew was explicit and detailed: "The announcement continued that what was known about Scorpion was that she was in transit back to the United States after her

mission, and that she thought she was being tailed and asked for instructions as to what to do, e.g., go check it out or simply continue in transit. We were told that that was the last that was heard from her. I remember thinking and talking about the possible scenarios, 'Russian submarine' being foremost on most, if not all, of our minds."

Another Nathanael Greene crewman confirmed Rule's account. Frank Greene said he learned of Scorpion even before the formal announcement. "I was a quartermaster, and all information generally flowed through us pertaining to navigation. Word spreads quickly among a crew of 130," he said. Nathanael Greene was returning to its home port in Charleston, South Carolina, from a seventy-day patrol when the message about Scorpion came in, Greene recalled. "We were nearing Bermuda," he said, "when we received orders from Subflot 6 to plot new courses in order to assist in the search for USS Scorpion." Greene concluded that the sub had been sunk by a Soviet torpedo. "The U.S. Navy has listening devices all over the floor of the ocean and taped everything."

Despite official denials, several informed sources allege the top-secret Sound Surveillance System (SOSUS) had indeed recorded an underwater duel between Scorpion and a Soviet submarine that ended when the Soviet launched a torpedo that struck and sank the American submarine. One former SOSUS operator, Vince Collier, came forward decades later to tell in chilling detail how he and other sailors in SOSUS School were shown a bootleg copy of the tape that graphically depicted the death of Scorpion.

The instructor who played the tape, Ocean Systems Technician Analyst First Class Richard Falck, confirmed the details in an on-the-record interview. Former SOSUS officials revealed that within hours of the sinking, the navy raided SOSUS facilities worldwide to seize all evidence—hydro-acoustic tapes, "lofargram" printouts, and documents—that pointed to the Soviet attack on Scorpion.

If the Soviets did in fact sink the Scorpion, navy officials at the time surely would have been mystified at how the Soviets could have overcome the clear technological superiority of an American nuclear submarine. They would not learn for nearly two decades a critical "unknown unknown"—in former Defense Secretary Donald Rumsfeld's now-famous phrase—that the only operational U.S. nuclear submarine to be lost at sea may have been caught up in a massive Soviet intelligence operation. By early 1968 that operation had led to the seizure of the electronic reconnaissance ship USS Pueblo and produced the infamous Walker Spy Ring, which ripped open the navy's top-secret coded communications channels to Soviet intelligence, until the conspirators were identified and arrested in 1985.

Captain Peter Huchthausen, a former U.S. naval attaché to the Soviet Union during the early 1980s, revealed during a series of interviews with me that he was convinced the U.S. and Soviet navies had quickly reached a highly classified accord soon after the Scorpion sinking.

Conversations with top Russian officials, including Vice Admiral Ivan M. Komarov, led him to conclude that the U.S. and the Soviet Union had agreed to suppress evidence about the demise of Scorpion, as well as the sinking of the Soviet sub K-129 a few weeks earlier, in order to forestall a politico-military crisis that could easily have flared into a general war between the two countries. Huchthausen had a subsequent conversation, after his retirement from active service, with retired Admiral Viktor A. Dyaglo, who in 1968 had commanded the Soviet submarine division to which K-129 had been attached. Huchthausen claimed Dyaglo told him there "was an unofficial agreement by senior submariners on both sides" that would prevent anyone from ever learning the full account of what had caused the two submarine sinkings.

The Scorpion incident did not occur in a vacuum. Throughout the 1950s and 1960s, scores of top-secret U.S. reconnaissance aircraft were attacked and some were shot down while attempting to spy on Soviet military capabilities. The U.S. Navy conducted aggressive tactics using submarines to spy on their Soviet counterparts. The Soviets in turn used spies and their military allies to wage limited war against America, as new information about the seizure of Pueblo shows.

A popular historical theory of the Cold War is that fear of nuclear war deterred the United States and the Soviet Union from engaging in a direct military confrontation. What the Scorpion incident suggests is that rather than preventing such confrontations, it merely drove them into the shadows.