PATRIOTS POINT
NAVAL & MARITIME
MUSEUM

Get Dazzled: STEAM into Camouflage

World War I and World War II saw the introduction of a variety of new technologies that changed the battlefield forever. One of the most influential was the submarine. Submarines wreaked havoc on conventional ships with their stealth and powerful torpedoes, sinking warships and disrupting **global trade routes** by attacking cargo ships. Suddenly, nations without a fleet of heavy battleships and aircraft carriers had a chance to dominate the seas with large numbers of small submarines. Though Germany is the best example of this, many nations used submarines to great effect in their **military strategies** during the 20th century.



From the collection at Patriots Point.
The view of the starboard side of the USS Yorktown (CV-10) sitting offshore of Puget Sound Navy Yard.

Submarines used periscopes to see what was going on above the surface of the ocean while they were underwater. Other ships used them to allow for sailors to look around while staying protected behind armor. Mirrors arranged inside of the periscope used reflection to bounce light into the user's eye.

With the submarine menace now clear, the need to counter these underwater foes grew. One novel idea came from civilians like John Kerr, a British zoologist, and Norman Wilkinson, a British artist who served in the Royal Navy. These men created new **camouflage** patterns for ships using inspiration from the natural world. They were particularly interested in disruptive camouflage, which is designed to break up the outlines of an object, even if has already been spotted. In the same way that a zebra's stripes break up its outline and make it difficult for a predator to tell which direction it is moving, a ship painted with contrasting stripes can be harder for an enemy submarine to aim at with a torpedo. Many ships, including the USS Yorktown and USS Laffey, were painted with these "dazzle" camouflage patterns.

They also used countershading, a strategy used by many marine animals (like sharks). By being dark on top and lightly colored on the belly, a shark can blend in with either the dark water or bright sunlight, depending on which direction it is viewed from. Countershading was also popular with US ships and even airplanes during World War II, allowing them to blend in with either the sea or sky depending on viewing direction.



From the collection at Patriots Point.
Colorized photograph of USS COLUMBIA CL56 at sea circa 1943, starboard surface view. This camouflage pattern is similar to the countershading used by sharks.

Camouflage patterns were designed on paper, modeled, and brought to life in shipyards using ratios and scale factors.

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About this Activity Kit

Objectives: This activity is designed to support, and demonstrate the integration of, science, social studies, and math within the context of WWI and WWII dazzle camouflage.

Vocabulary/themes: WWI, WWII, camouflage, trade/global trade, global interdependence, geographic influence on military strategies, light, mirrors, periscopes, submarines, camouflage, reflection, color, sight

Standards reached and/or related, but not limited, to this kit:

Grade	Social Studies	Science	Math
3		• 3-LS4-3	• 3.MGSR.3.1-3.2
4		• 4-PS4-2	• 4.MGSR.3.1
5	• 5.3.CX		
6	• 6.5		• 6.MGSR.2.1
7			• 7.MGSR.2.2-2.3
8			• 8.MGSR.2.1
9-12			• GS.MGSR.2.1

Materials Needed (* included):

- 10 2" x 2" x 7" Cardboard Boxes*
- 20 2" x 2" Mirrors*
- Periscope Math* master copy
- How a Periscope Works* master copy
- Periscope Assembly* master copy
- Scissors
- Tape
- Warship templates*master copy
- USS Laffey Dazzle Camo Worksheets (11 x 17; 1 per 5 students)* (and answer key; 8 ½ x 11)
- Crayons* or paint (light gray, dark gray, black)
- Canvas/Butcher Paper (24inch)

Prior to beginning Activities 1-4 make sure students understand the material presented in "Get Dazzled: STEAM into Camouflage". Read aloud to class and discuss or for older students have them read on their own.

Activity 1: Build Your Own Periscope:

To build the periscope you will use the mirrors, cardboard boxes, periscope assembly instructions, periscope math sheet if grade appropriate, tape, and scissors.

- Distribute 1 box and 2 mirrors along with access to scissors and tape to students in groups (2-3 students)
- Following the assembly instructions have them build their periscope
- Work on optional periscope math worksheet if grade appropriate

Activity 2: Dazzle Camouflage

- Depending on time, either copy ocean backgrounds sourced from books, pictures, or the internet OR have students draw their own seascape (ocean landscape)
- If they drew their own seascape, have them trade
- Using the warships template have students design their own camouflage to go with the seascape they are using. Will they try to dazzle and disorient their enemy like a zebra ? Will they try to blend in? What camouflage strategy will they use?
- Have students cut out and tape or glue their ship onto their background

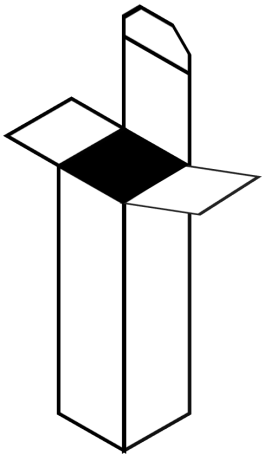
Activity 3: Testing out Periscopes

- In their groups, have students take turns moving their camo designs and backgrounds around the room while remaining group members use the periscope to spot the disguised carriers
- How long does it take to identify different parts of the ship, and which ship is which? Which camouflage patterns are most effective, if any?

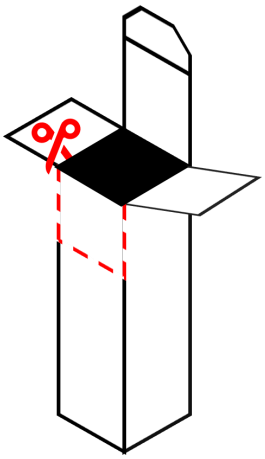
Activity 4: Scale Factors and "Murals"

Have students read or made aware of the information found in "Behind the Scenes: Building and Painting", informational text in this packet, prior to beginning.

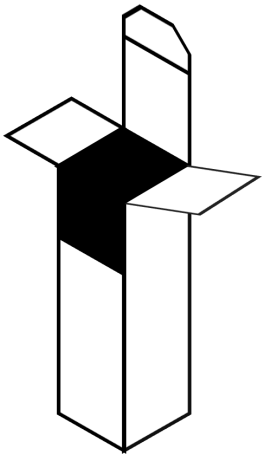
- Have students answer in groups or as a class, the questions on the USS Laffey Dazzle Camo Worksheets (11 x 17).
- Create a grid on canvas or butcher paper that is 15 squares long by 4 squares tall. Each square should be 5 inches by 5 inches.
- Determine how many squares per student (or students per square) will need to be assigned based on your class size to complete a "mural" of the USS Laffey using the guide on the 11 x 17 worksheet.
- Use the black, dark gray, and light gray crayons provided or paint to fill in the squares and outlines with the correct colors.



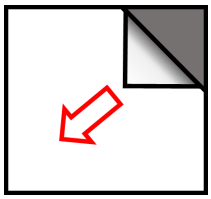
1. Unfold your cardboard box. Open one side.



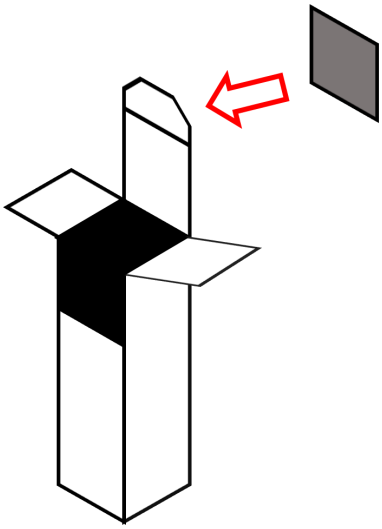
2. Cut out a square from your box (see picture). You can use one of your mirrors as a template.

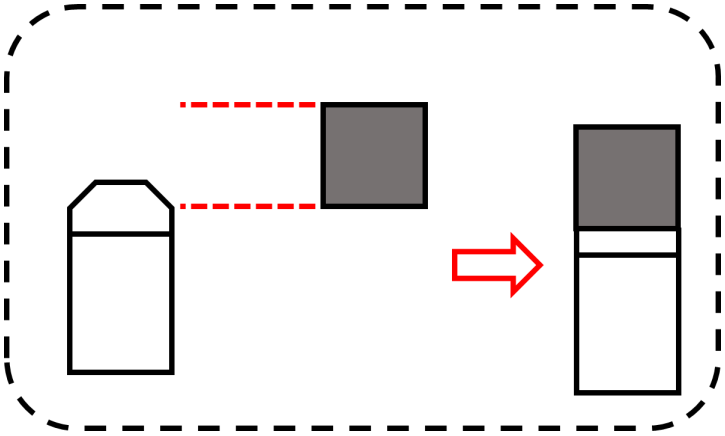


3. Your box should now look like this.

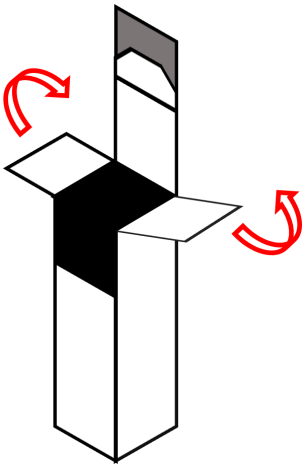


4. Peel the cover off of the back of your mirror so that the sticky side is showing.

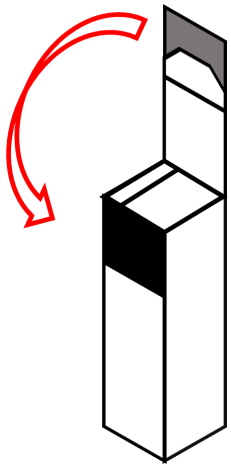




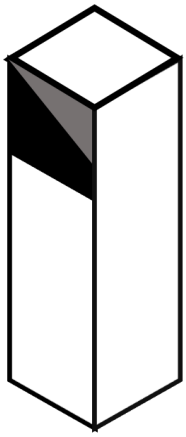
5. Stick the mirror on the top side of the box lid. The mirror should only cover about half of the flap at the end of the lid (see the picture on the right). Most of the mirror should hang off the flap.



6. Close the two side flaps



7. Fold the top flap down so that the mirror goes in the hole.



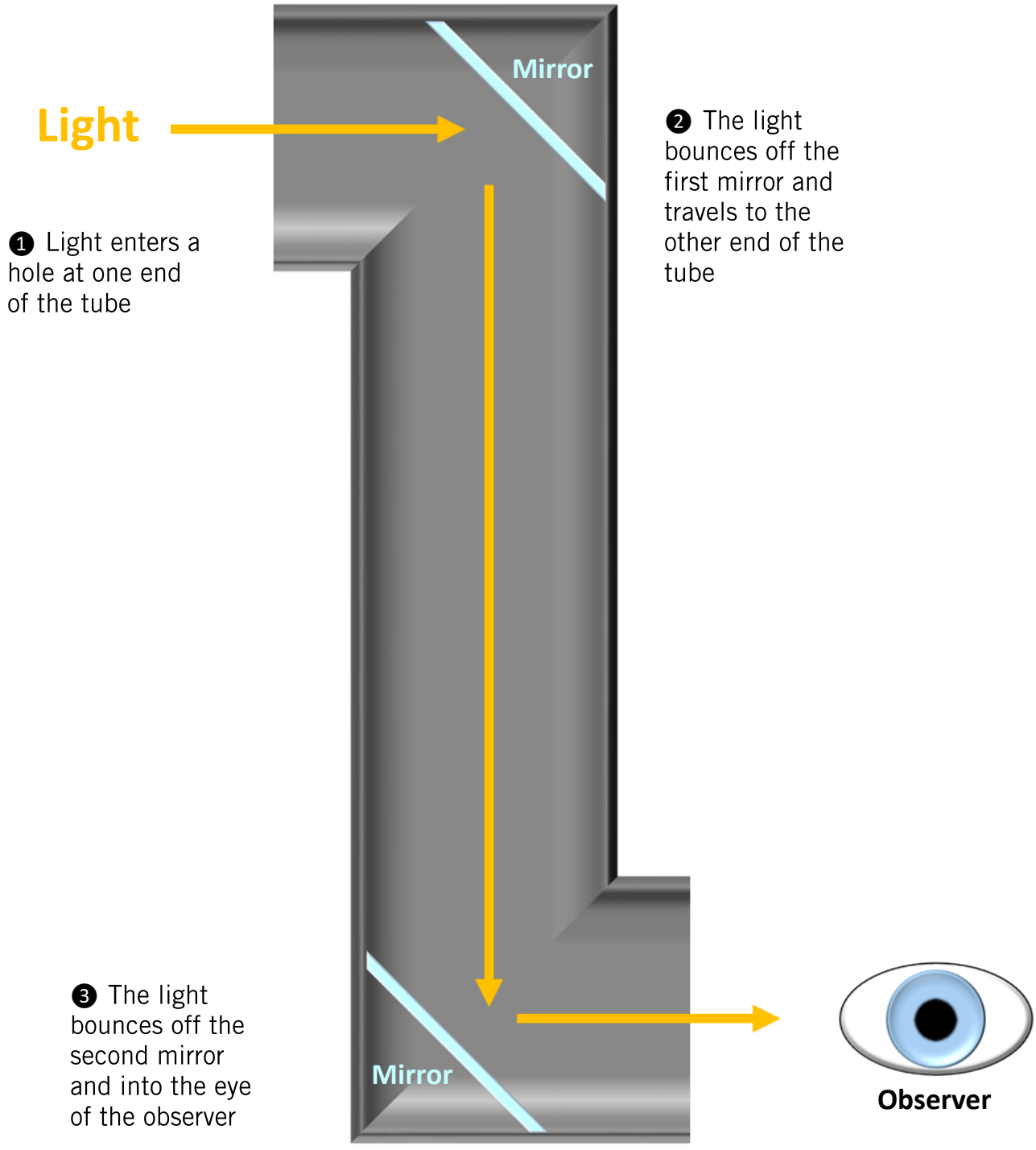
8. Use tape to make sure that the mirror is attached to the back wall of the box. It should be diagonal.

Repeat all previous steps

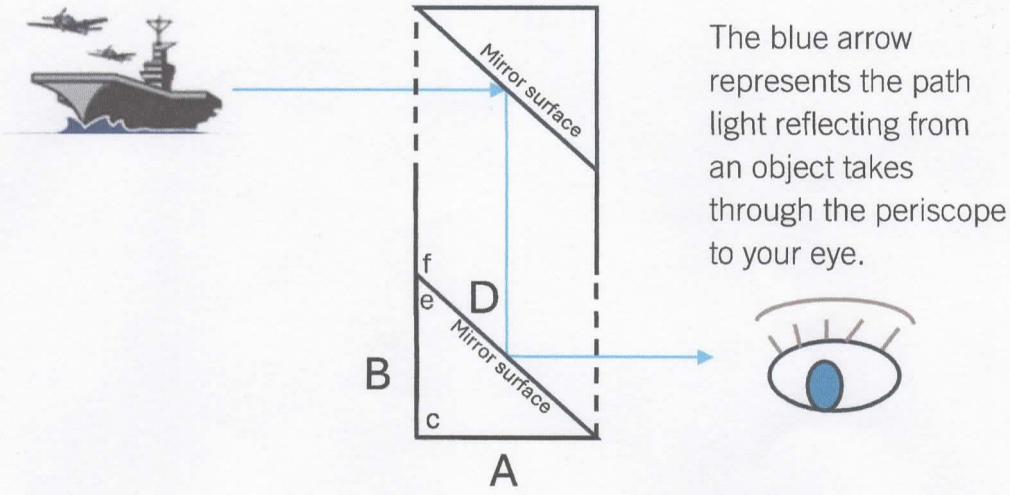
9. Repeat steps 1-9 with the other end of the box. You should now have a working periscope.

How a Periscope Works

- **Reflection** is when a wave changes direction after hitting a surface.
- A common example of this in everyday life is when light waves reflect off of a mirror and into your eye.
- A periscope uses two mirrors to reflect light from one end of a tube to the other.



Periscope Math



The blue arrow represents the path light reflecting from an object takes through the periscope to your eye.

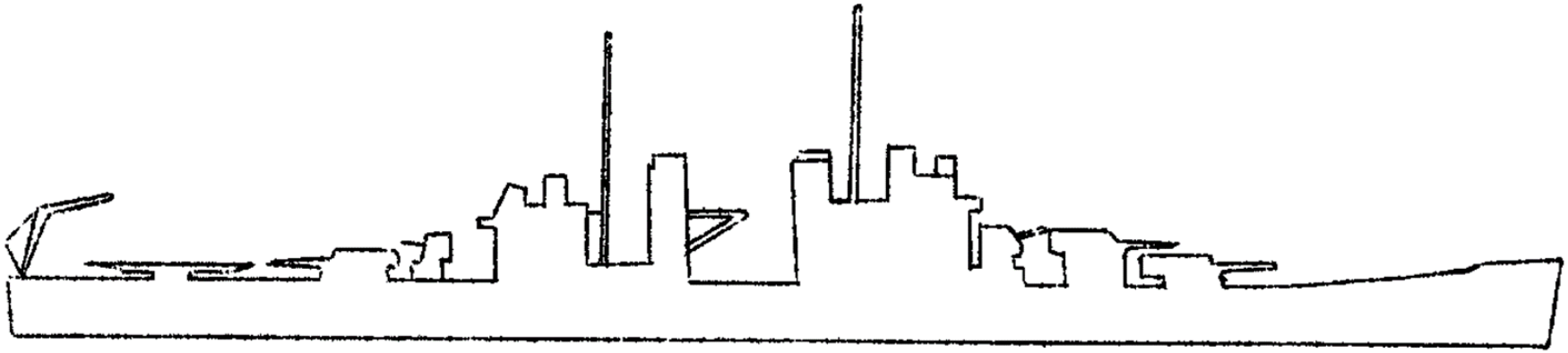
1. Are **line segments A and B** perpendicular to each other or parallel?

2. Is **angle c** acute, right, or obtuse?

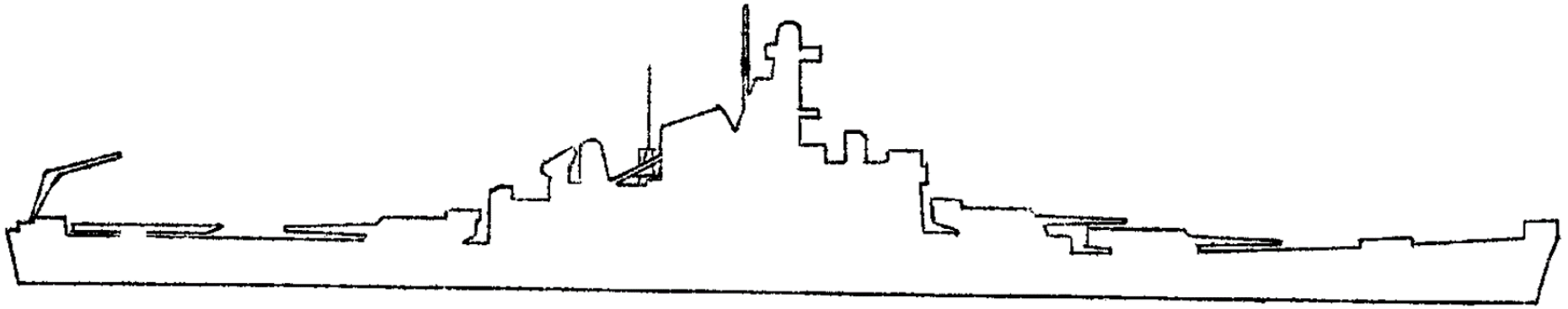
3. Is **triangle ABD** acute, obtuse, right, or equiangular?

4. In question #3 above are you classifying the triangle according to side length or according to angle measure?

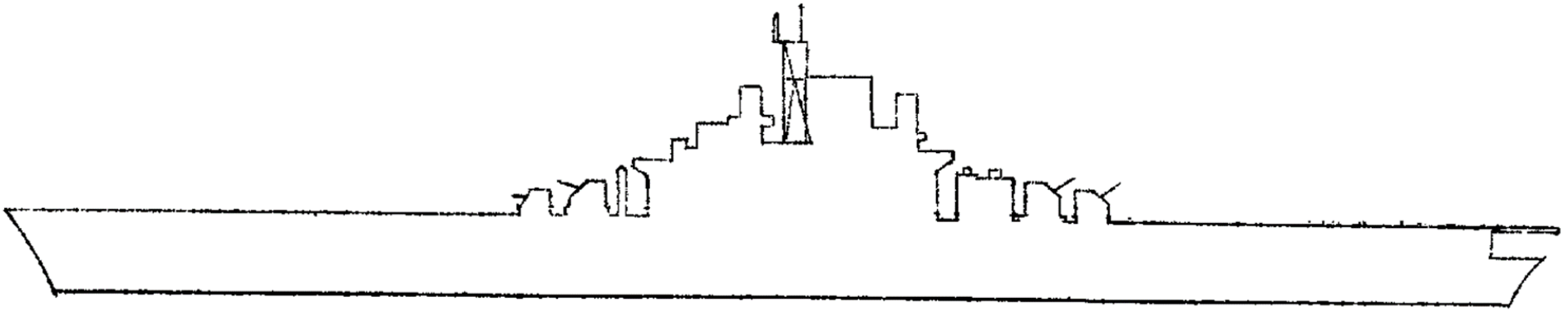
5. Are **angles e and f** complimentary or supplementary? Explain?



Cruiser (USS New Orleans CA-32)

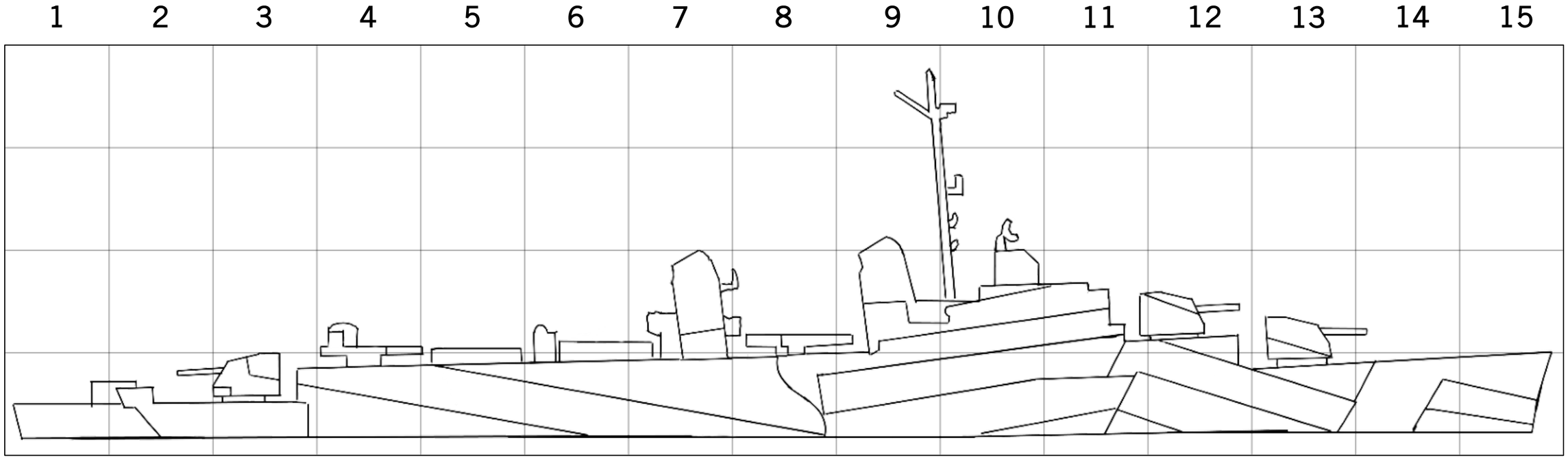


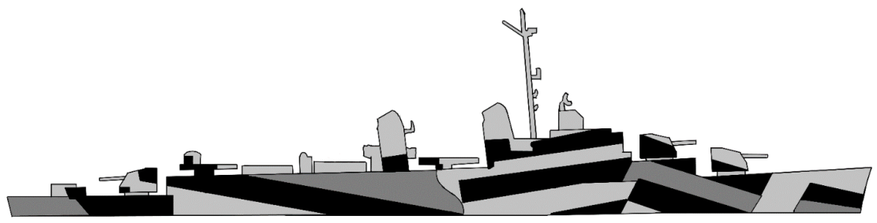
Battleship (USS South Dakota B-57)



Aircraft Carrier (USS Yorktown CV-10)

These silhouettes were scanned from actual WWII restricted documents describing Japanese and United States Warships. From the collection at Patriots Point.





1. Each square on the grid above is 1 inch by 1 inch. The squares on the craft paper will each be 5 inches x 5 inches. What is the scale factor needed to convert a small square into large one? 1:5

2. Using your answer from #1, find the length and width of the completed mural. 75 inches x 20 inches

3. The real Laffey is 376.5 feet long, equal to 4518 inches. What is the scale factor of the real ship when comparing it to the smaller grid image above, where the ship is 14.81 inches long? Approximately 1:305

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Historical and Modern Careers related to Aircraft Carriers

Behind the Scenes: Building and Painting

What happens before and after Patriots Point Naval and Maritime Museum opens and closes? Painters, welders (shipfitters), plumbers (pipefitters), electricians, and many more maintenance technicians are hard at work keeping the Fighting Lady in tip-top shape for her visitors. These experts are similar to those that would have helped maintain and even build the aircraft carrier and other vessels for the United States Navy both in WWII and today.

Ships are built, painted, and receive major repairs in places called shipyards. The Charleston Navy Yard, also known as the Charleston Naval Shipyard, was in operation from 1901 to 1996. Over these many years the Navy Yard would build, repair, and maintain hundreds of ships. While the shipyard would never build an aircraft carrier it would build destroyers similar to USS Laffey, and the process was much the same as the ones used by shipyards with big enough facilities to build aircraft carriers. Even after the Navy officially shut down the facilities other organizations have continued to rent space to work on their own ships, including Patriots Point when the USS Laffey needed more extensive repairs than could be done while at Patriots Point.

The two main types of facilities at a shipyard like the Charleston Navy Yard are slipways and dry docks. Slipways are angled tracks that ships can be built on and then used to slide the ship into the water. A dry dock is used to repair and maintain an already built ship. The dry dock is filled with water allowing the ship to be floated in, then the water is drained to allow the bottom half of the ship to be accessed. Barnacles and other sea creatures like to attach themselves the bottoms of ships, and they need to be removed. Once that is done, the bottom of the ship can be repainted, since the paint protects the metal in the ship's hull from rusting in seawater.

A warship's paint serves another important purpose in addition to protecting from rust, and that is camouflage. The dazzle camouflage of WWI and WWII is now obsolete, however most Naval ships are still painted to blend in with their oceanic surroundings. As the saying goes, "Haze gray and underway."



The USS Laffey in drydock at Deytens Shipyard, 2009. From the collection at Patriots Point Naval and Maritime Museum.