Name: _____ Date: _____

Mapping the Harbor Floor With Sound

Circle group

Ships need to know what is under them. But the bottom of a harbor is hidden under dark, muddy water. Hydrographic surveyors map it. Their main tool is sound.

A survey boat has a sonar unit fixed to its hull. The unit sends a pulse of sound straight down. The pulse bounces off the bottom and comes back. Sound moves through water at a known speed. So the time the trip takes tells the depth. New units send many pulses in a fan shape. One pass of the boat measures a wide strip of the bottom, not just one line.

A depth is not useful without a place. A satellite receiver on the boat records where each measurement was taken. The boat goes back and forth in parallel lines, like someone mowing a lawn, until the whole area is done.

Surveyors must also fix for the tides. Water that is deep at high tide may be too shallow later. So surveyors record the water level and adjust each depth to a standard level. If they did not, charts from different times would not agree.

The results become nautical charts. Captains use them to stay in safe channels and avoid sandbars and wrecks. Storms and currents move sand and mud, so the work is never done. Channels are surveyed again and again. A chart is only good while it is up to date.

Questions

1. What is the main tool of a hydrographic surveyor?

_____

_____

2. How does the sonar unit find how deep the water is?

_____

_____

3. Why does the boat go back and forth in parallel lines?

_____

_____

4. Why must surveyors fix for the tides?

_____

_____

5. What do captains use nautical charts for?

_____

_____

6. Why is a depth not very useful without a place?

_____

_____

7. Why are the same channels surveyed again and again?

_____

_____

Words to know

hydrographic: having to do with measuring and mapping bodies of water
sonar: a device that uses sound to find objects or measure depth under water
hull: the main body of a boat that sits in the water
tides: the regular rising and falling of the sea
nautical: having to do with ships and sailing

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

Mapping the Harbor Floor With Sound

Triangle group

Ships need to know what lies beneath them, yet the bottom of a harbor is hidden under water that is too dark and muddy to see through. The people who map it are hydrographic surveyors, and their main tool is sound.

A survey boat carries a sonar unit fixed to its hull. The unit sends a pulse of sound straight down, and the pulse bounces off the bottom and returns. Because sound travels through water at a known speed, the time the trip takes reveals the depth. Modern units send out many pulses in a fan shape, so a single pass of the boat measures a wide strip of the bottom rather than a single line.

Depth alone is not useful without a location. A satellite positioning receiver on the boat records exactly where each measurement was taken. The boat then travels back and forth in careful parallel lines, like someone mowing a lawn, until the whole area is covered.

Surveyors must also correct for the tides. Water that is deep at high tide may be dangerously shallow hours later, so the surveyors record the water level and adjust every depth to match a standard reference level. Without this step, charts from different times would not agree.

The results become nautical charts, the maps that captains use to stay in safe channels and avoid sandbars and wrecks. Because storms and currents move sand and mud, the work is never really finished. Channels are surveyed again regularly, and a chart is only trustworthy while it is up to date.

Questions

1. What is the main tool of a hydrographic surveyor?

_____

_____

2. How does the sonar unit find out how deep the water is?

_____

_____

3. Why does the boat travel back and forth in parallel lines?

_____

_____

4. Why must surveyors correct for the tides?

_____

_____

5. What do captains use nautical charts for?

_____

_____

6. Why is a depth reading not very useful without a location?

_____

_____

7. Why are the same channels surveyed again and again?

_____

_____

Words to know

hydrographic: having to do with measuring and mapping bodies of water
sonar: a device that uses sound to find objects or measure depth under water
hull: the main body of a boat that sits in the water
tides: the regular rising and falling of the sea
nautical: having to do with ships and sailing

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

Mapping the Harbor Floor With Sound

Square group

Ships need to know exactly what lies beneath them, yet the bottom of a harbor is concealed beneath water that is far too dark and muddy to see through. The specialists who map it are hydrographic surveyors, and their principal tool is sound.

A survey boat carries a sonar unit fixed securely to its hull. The unit sends a pulse of sound straight downward, and the pulse bounces off the bottom and returns to the boat. Because sound travels through water at a known speed, the time that the round trip takes reveals the depth. Modern units transmit many pulses in a wide fan shape, so a single pass of the boat measures an entire broad strip of the bottom rather than one narrow line.

Depth alone is of little use without a location. A satellite positioning receiver on the boat records precisely where each measurement was taken. The boat then travels back and forth in careful parallel lines, rather like someone mowing a lawn, until the whole area has been covered.

Surveyors must also correct for the tides. Water that is deep at high tide may be dangerously shallow only a few hours later, so the surveyors record the water level and adjust every depth to match a standard reference level. Without this step, charts made at different times of day would not agree with one another.

The results are turned into nautical charts, the maps that captains consult to remain in safe channels and to steer clear of sandbars and wrecks. Because storms and currents continually move sand and mud, the work is never truly finished. Channels are surveyed again at regular intervals, and a chart can be trusted only for as long as it remains up to date.

Questions

1. What is the principal tool of a hydrographic surveyor?

_____

_____

2. How does the sonar unit discover how deep the water is?

_____

_____

3. Why does the boat travel back and forth in careful parallel lines?

_____

_____

4. Why must surveyors correct for the tides?

_____

_____

5. What do captains consult nautical charts to do?

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_____

6. Why is a depth reading of little use without a location?

_____

_____

7. Why are the same channels surveyed again at regular intervals?

_____

_____

Words to know

hydrographic: having to do with measuring and mapping bodies of water
sonar: a device that uses sound to find objects or measure depth under water
hull: the main body of a boat that sits in the water
tides: the regular rising and falling of the sea
nautical: having to do with ships and sailing

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

For the teacher: Mapping the Harbor Floor With Sound

Each student sheet carries a shape, not a level. The same topic and facts, written three ways.

Circle: Mapping the Harbor Floor With Sound

Easier · 232 words · Flesch-Kincaid grade 3.9

1. Sound, sent out by a sonar unit on the boat.
2. It times how long a pulse of sound takes to bounce off the bottom and come back.
3. To cover the whole area, like mowing a lawn.
4. The water level rises and falls, so depths from different times would not agree.
5. To stay in safe channels and avoid sandbars and wrecks.
6. A mapmaker needs to know where on the bottom each depth was measured.
7. Storms and currents move sand and mud, so the bottom changes.

Triangle: Mapping the Harbor Floor With Sound

This passage · 258 words · Flesch-Kincaid grade 8.1

1. Sound, sent out by a sonar unit on the boat.
2. It times how long a pulse of sound takes to bounce off the bottom and return.
3. To cover the whole area, like mowing a lawn.
4. The water level rises and falls, so depths measured at different times would not agree.
5. To stay in safe channels and avoid sandbars and wrecks.
6. A mapmaker must know where on the bottom each depth was measured.
7. Storms and currents move sand and mud, so the bottom changes.

Square: Mapping the Harbor Floor With Sound

Harder · 291 words · Flesch-Kincaid grade 9.2

1. Sound, sent out by a sonar unit on the boat.
2. It times how long a pulse of sound takes to bounce off the bottom and return.
3. So that the whole area is covered, rather like mowing a lawn.
4. The water level rises and falls, so depths measured at different times would not agree.
5. Remain in safe channels and steer clear of sandbars and wrecks.
6. A mapmaker must know precisely where on the bottom each depth was measured.
7. Storms and currents continually move sand and mud, so the bottom keeps changing.