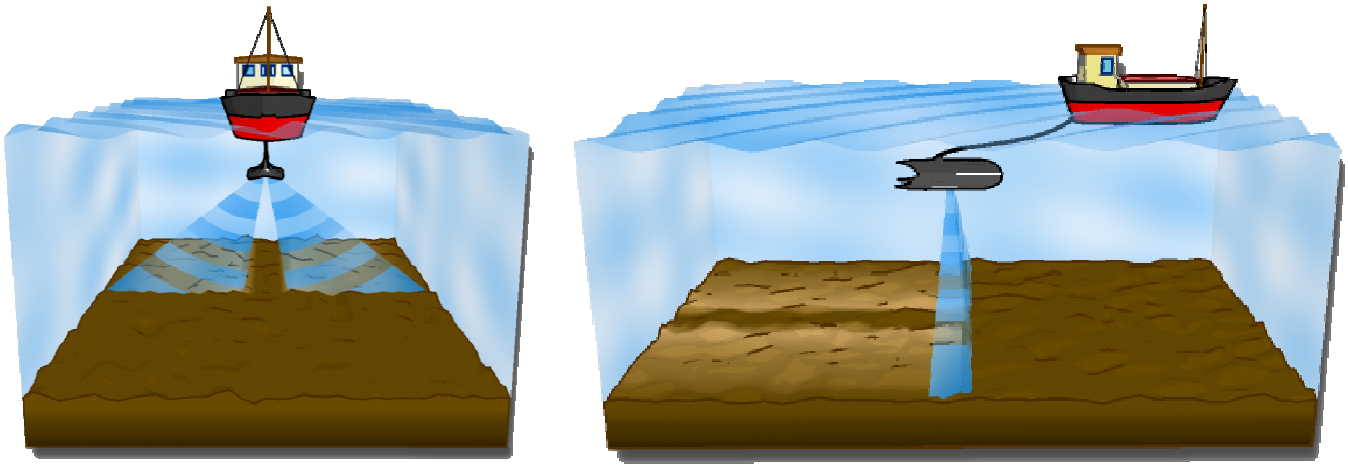
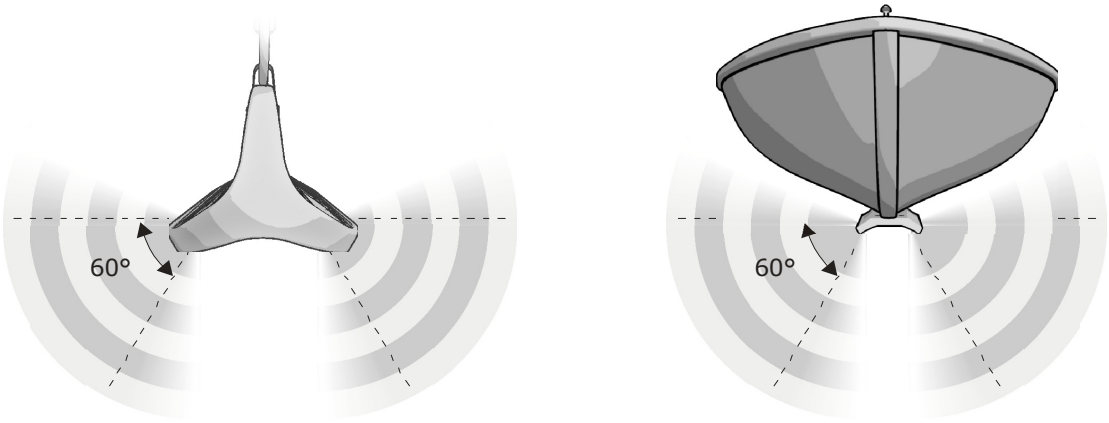
WHAT IS A SIDESCAN SONAR...

- Sonar (SOund, NAvigation and Ranging) is a technique that uses sound waves to detect and locate objects underwater.
- Side scan sonar, also referred to as side-looking sonar or side-imaging sonar, is a specific type of sonar used to image the topography of the seafloor.
- Side scan sonars are often towed from a survey vessel (although can be mounted to a boat hull, or pole-mount bracket) and transmit a narrow fan-shaped acoustic pulse (ping) perpendicular to its direction of travel.



- The StarFish sidescan has two transducers (transmitter and receiver elements) mounted in the lower fins. These transducers are angled 30° down from the horizontal, and acoustically transmit sound in a “fan beam” 0.4° wide, by 80° vertically - although most of the acoustic energy is confined to the centre 60° of the beam. This gives the StarFish the ability to see almost directly below it, to just above the horizontal.



- As the acoustic pulse (or “ping”) travels outward from the side scan sonar, the seabed and other objects (referred to as “targets”) reflect some of the sound energy back in the direction of the sonar (the “echo”).
- For each ping, the travel time of the returned echo is recorded together with its amplitude (volume) and sent to a topside console for interpretation and display.
- The topside stitched the data together over time from successive pings, and creates a long continuous image of the seafloor – referred to as a “waterfall” type display.

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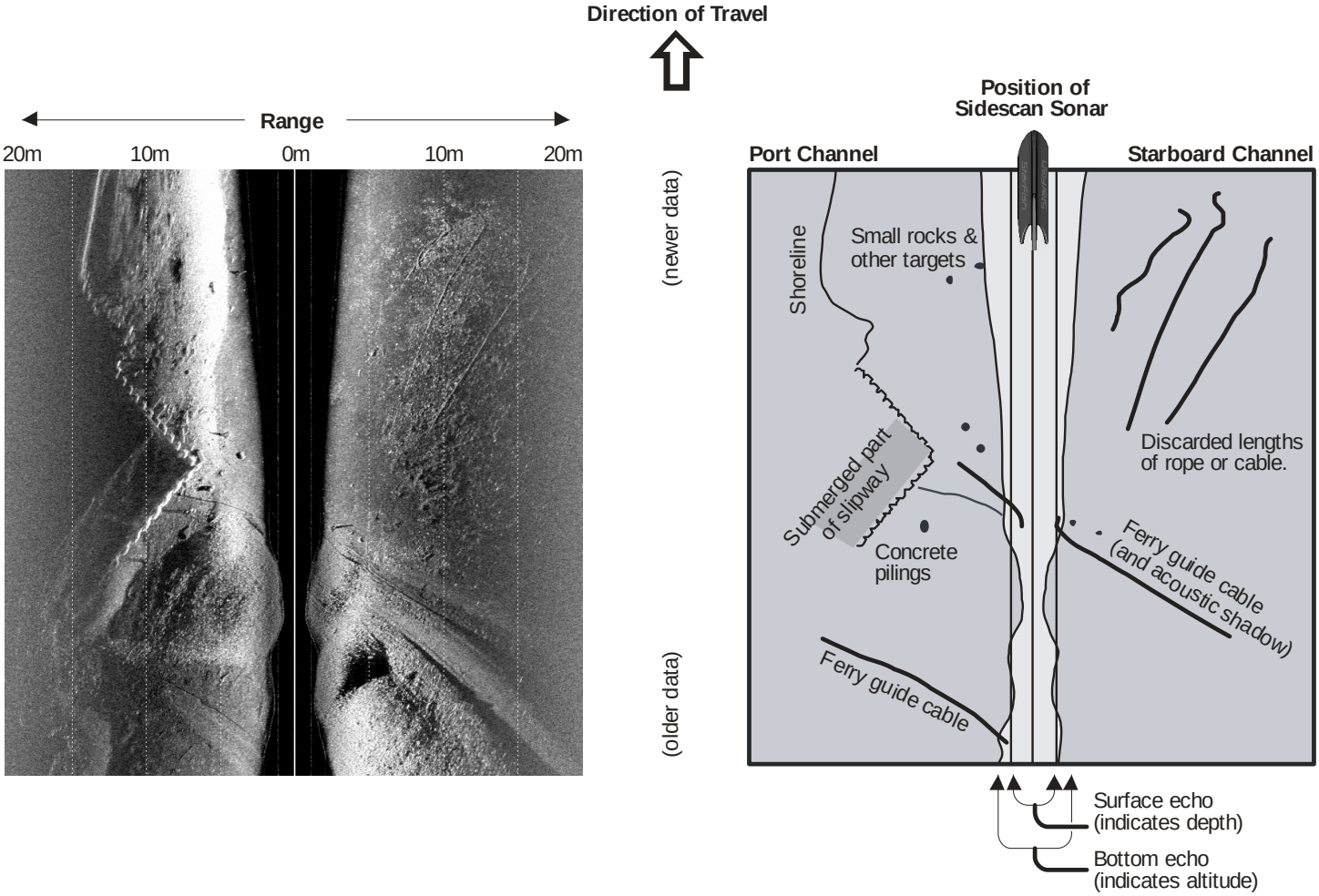
SIDESCAN IMAGERY…

- Interpretation of side scan sonar data develops with experience, and using a side scan sonar is rather like looking at a world made of shiny black plastic, in the dark, from above, with only a narrow torch beam for illumination.
- Below is a typical "waterfall" type sidescan image showing the slipway and shoreline of a cable-hauled ferry across a lake.



- Each new ping performed by the sonar is added to the top of the display, which scrolls downwards and older data will eventually disappear off the bottom.
- From the sonar in the centre, range extends out to the left and right (on the port and starboard channels respectively).
- As with any acoustic sonar, side scan sonars only show echoes of objects that reflect sound back to the receiver. Materials whose density differs from that of water will reflect back more sound.
  - Materials, such as air, metals, boulders, gravel or recently extruded volcanic rock, are very efficient at reflecting acoustic pulses (high backscatter).
  - Finer sediments like clay and silt, on the other hand, do not reflect sound well (low backscatter).
- Strong reflectors create strong echoes, while weak reflectors create weaker echoes. Knowing these characteristics, you can use the strength of acoustic returns from the side scan sonar to examine the composition of the seafloor and any objects which may lay on it.
- Sometimes highly reflective targets are only seen when they are at right angles to the sonar and rough seabed textures can blot out smaller targets completely.

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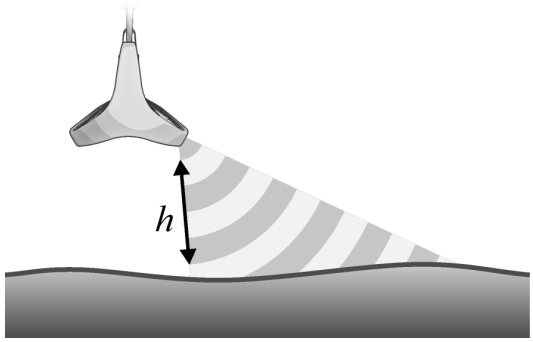
INTERPRITING IMAGES…

- A useful measure to know when towing a side-scan sonar is the height above the seafloor, so a safe distance can be maintained and hazards avoided.

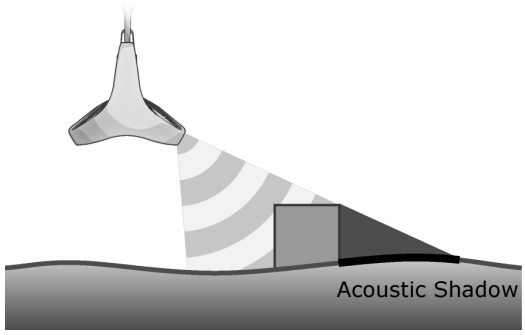
ALTITUDE

- "Altitude" is the height the sonar is above the seabed, and should not be confused with "depth" (the distance the sonar is down from the surface).
- Looking at the previous image, we can see a large black "hour-glass" shaped area in the middle of the display, where no echoes have been received.
- In fact this area is showing us the height the sonar is above the sea bed. The nearest object to the sonar will always be the seabed below it (assuming a relatively flat seabed).
- However, it will take some time for the "bottom echo" to be returned, and as the display shows the received echoes from when the transmission started, this area appears black.
- At the bottom of the previous sonar image we can see that the sonar passed over a shallow area then went on into deeper water.



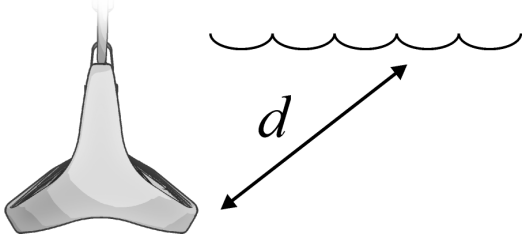
ACOUSTIC SHADOWS

- When sound from the sonar hits a submerged target with any height above the seabed, an acoustic shadow will be cast away from the sonar.
- An experienced sonar operator can use the lengths of these shadows, along with knowledge of the sonar altitude to get an idea of the size and height of the object.
- To help understand this, imagine you are in a darkened room, with a flashlight, standing above a ball. If you shine the flashlight down on the ball, a small shadow is cast around it, while if you lie down level with the ball and shine the light at it, a much longer shadow is produced stretching away from it.



DEPTH

- We have previously seen how we can estimate the altitude of the sonar above the seabed, and we can use a similar technique to estimate the sonar depth below the surface.
- In the previous sonar image we can see two bright lines close to and on either side of the sonar. These echoes are produced by the transmitted sound from the sonar hitting and being reflected back from the surface of the water
- As the sound does not leave the sonar at 90° straight up, we cannot use this as a true depth, but it gives a good rough estimate for general use.



- However, depending on your sonar configuration, towing depth and the acoustic conditions of the water, be aware that these echoes are <u>not</u> always strong enough to be visible on the display.

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