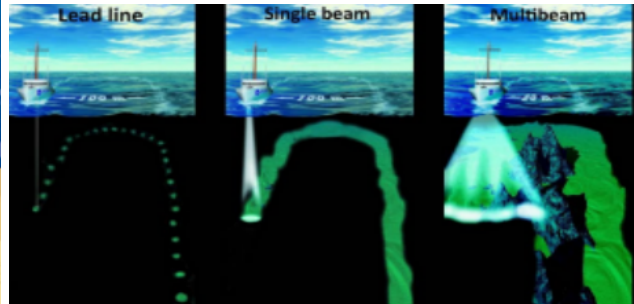
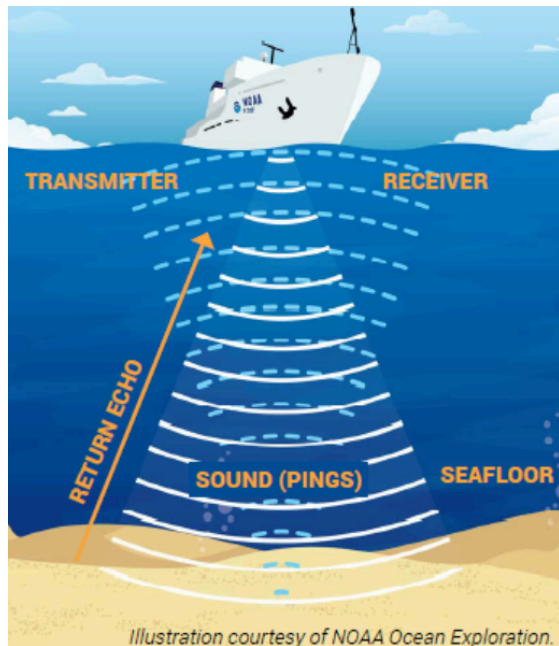




Ship Sonar Systems

- A sonar system's transducer sends sound waves into the water, which travel until they hit an object.
- Sound waves interact differently with various objects depending on the materials they are made of; harder objects, such as rocks, reflect more sound, while softer objects, like sand, absorb more sound.
- The transducer measures reflected sound waves to determine how far away the object is based on the time it takes for the sound to return.
- A multibeam sonar system uses multiple transducers to create detailed maps of larger ocean areas by pointing in different directions.
- Lower frequencies are used by ship-based sonar systems. Operation at low frequencies is necessary because water readily absorbs high-frequency sound waves, especially with increasing depth; however, such operation yields low-resolution images, with each image pixel representing a football field in size.

Seafloor Mapping

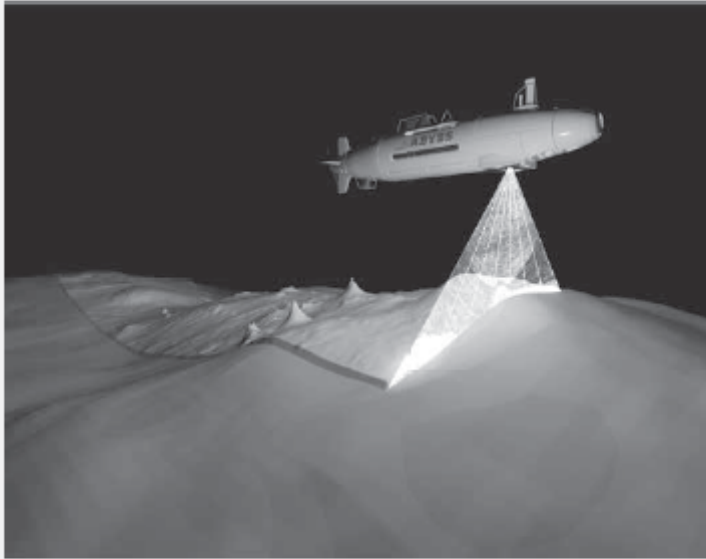


Image courtesy of T. Kwasnitschka and N. Augustin, GEOMAR Helmholtz Centre for Ocean Research, Kiel

UUV/AUV Sonar Systems

- A sonar system's transducer sends sound waves into the water, which travel until they hit an object.
- Sound waves interact differently with various objects depending on the materials they are made of; harder objects, such as rocks, reflect more sound, while softer objects, like sand, absorb more sound.
- The transducer measures reflected sound waves to determine how far away the object is based on the time it takes for the sound to return.
- A multibeam sonar system uses multiple transducers to create detailed maps of larger ocean areas by pointing in different directions.
- Higher frequencies are used by underwater vehicles.
- Sonar systems on AUVs operate at higher frequencies than ship-based systems, within a few hundred meters of the seafloor.
- These systems generate maps with each pixel representing one square meter or less, resulting in 10,000 times more pixels than images made with lower frequency sonar systems. Artemis was using a type of sonar called side-scan sonar to scan the Indian Ocean's craggy bottom, sending out waves of low-frequency sound in a fan shape. This creates "slices" of the seafloor that can be compiled into an image with nearly as much detail as a photograph.