Seabed Characterization Using Acoustic Communication Signals on an Autonomous Underwater Vehicle With a Thin-Line Towed Array

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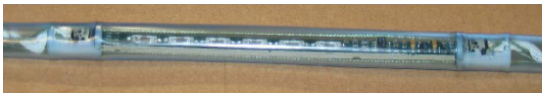
Navy Relevance of Seabed classification

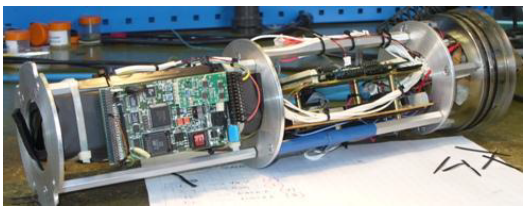
1. MCM applications:
    1. MCM sonar performance prediction
    2. Mine burial prediction
2. ASW applications:
    1. ASW sonar performance prediction
    2. Passive detection range estimation

Abstract:
Seabed classification was demonstrated using the self-noise of an autonomous underwater vehicle (AUV) received on a short towed array. The adopted approach was to separate the direct path and the surface- and bottom-reflected signals. Electrical interference from the source was used to verify source receiver separation. The amplitude ratio of the bottom reflected to the direct path signal levels, after compensating for the differences in absorption, spreading losses, and beam patterns, yields the bottom-reflection loss, at the applicable grazing angle. The latter is calculated from the travel time difference between the direct path and bottom-reflected signals. The method is self-calibrating, requiring absolute calibration of neither sound source nor receivers. The definitive isolation of the reflected and direct path signals and the self-calibrating property make this approach robust. The reflection loss may be compared to known seabed models to estimate sediment type.

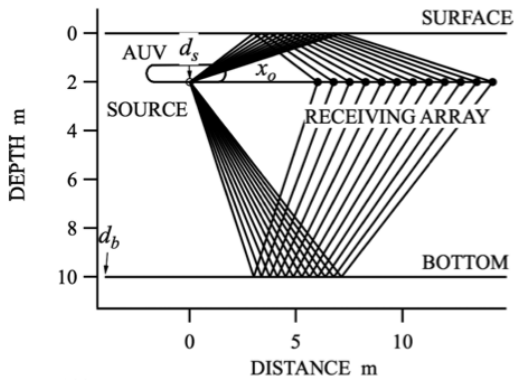


One array element: 1 cm dia. approx.

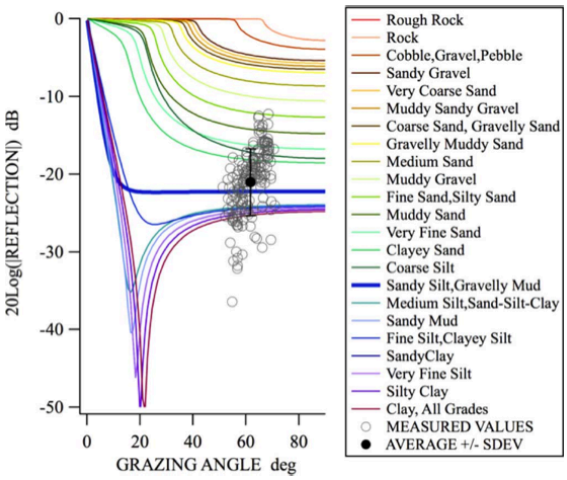
Array and cable



Array receiver and data recorder



Collection of acoustic communication signals: Direct path, surface and bottom reflected paths.



Seabed classification result from a muddy area

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