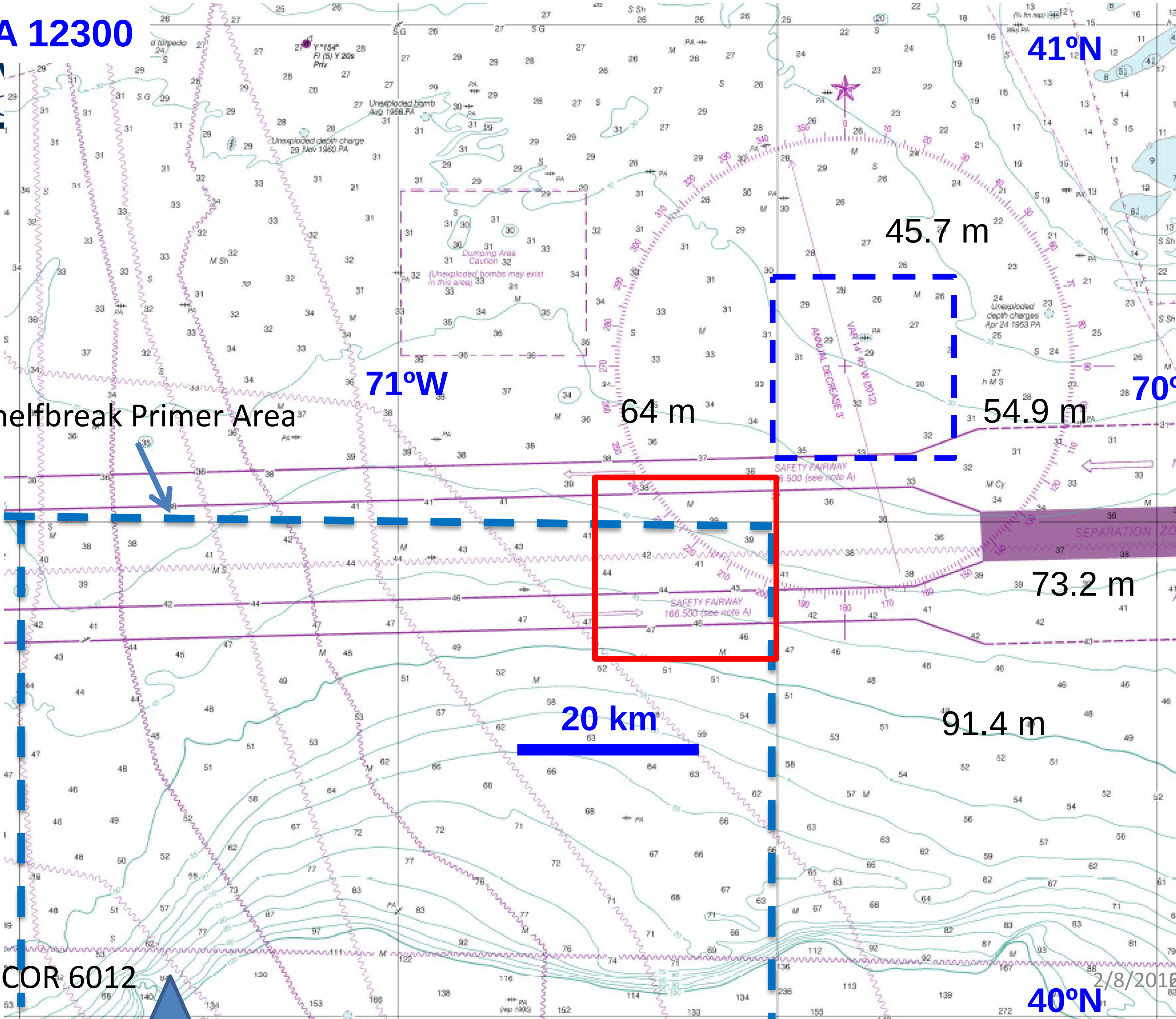
THE UNIVERSITY OF RHODE ISLAND

Thoughts on the experimental design for the proposed mud-patch field study

Profs. James H. Miller and Gopu R. Potty
Dept. of Ocean Engineering
University of Rhode Island
Narragansett, RI 02882

ONR Seabed Characterization Experiment 2016 - Workshop III
Applied Research Laboratories, The University of Texas at Austin
09-11 December, 2014

NOAA 12300


41ºN
45.7 m
71ºW
70ºW
64 m
54.9 m
Shelfbreak Primer Area
73.2 m
20 km
91.4 m
AMCOR 6012
40ºN

Sediment Cores from Primer

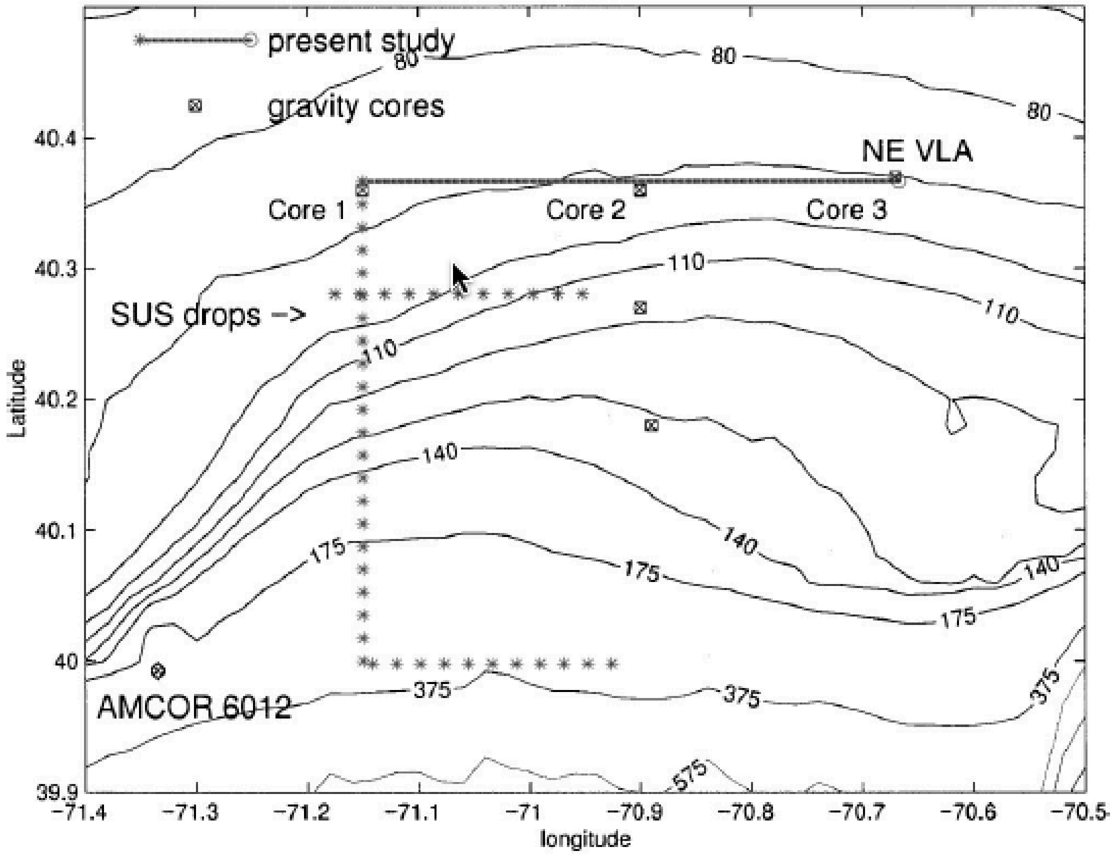


FIG. 4. The SUS drop locations at the experimental site. The AMCOR site is shown in the lower left corner of the figure. The propagation path corresponding to the present study is also shown. The gravity cores on this path (cores 1–3) are used in this study for the comparison and validation of the inversion.

Potty, G., J. H. Miller, J. F. Lynch, and K. B. Smith, "Tomographic inversion for sediment parameters in shallow water," *J. Acoust.* Soc. Am, 108(3), pp. 973-986, (2000).

THE UNIVERSITY OF RHODE ISLAND

AMCOR-6012 Compressional Speed

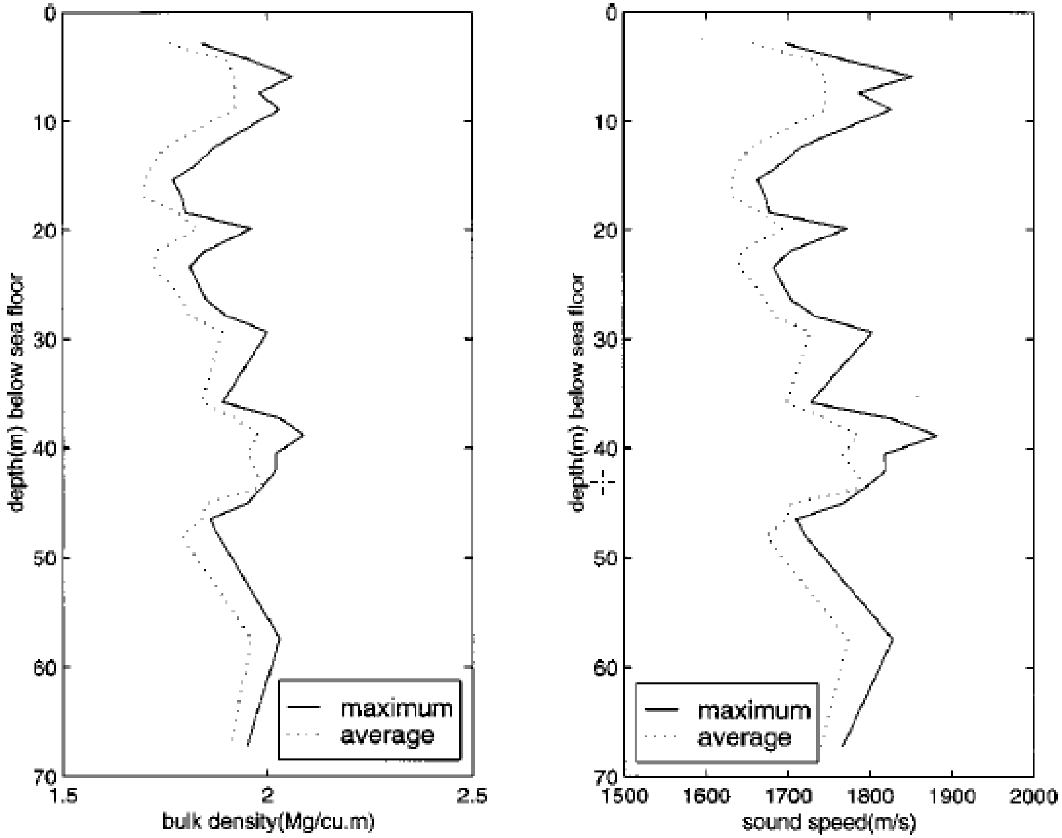
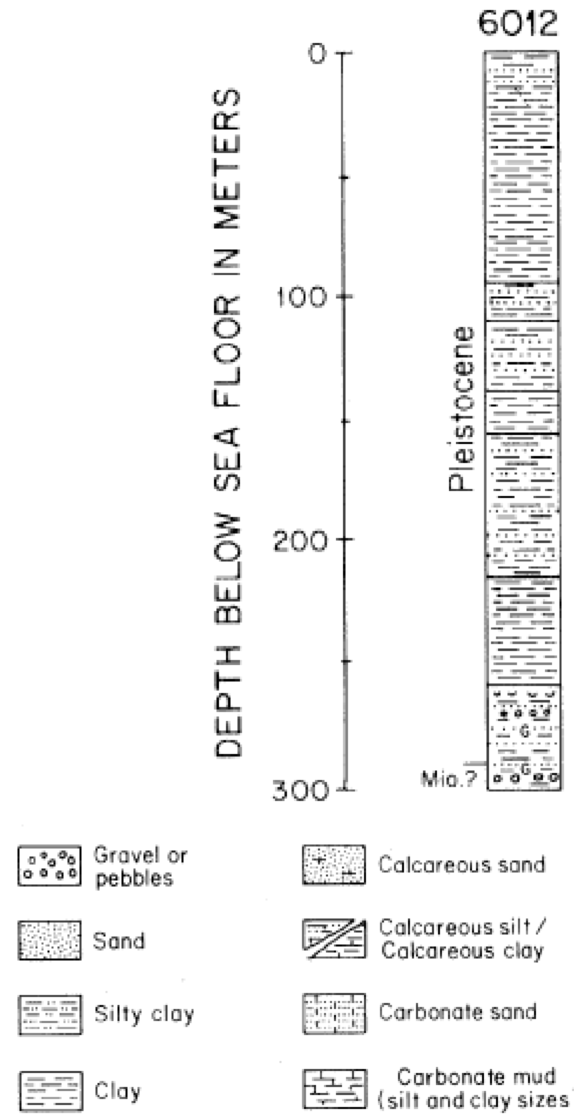


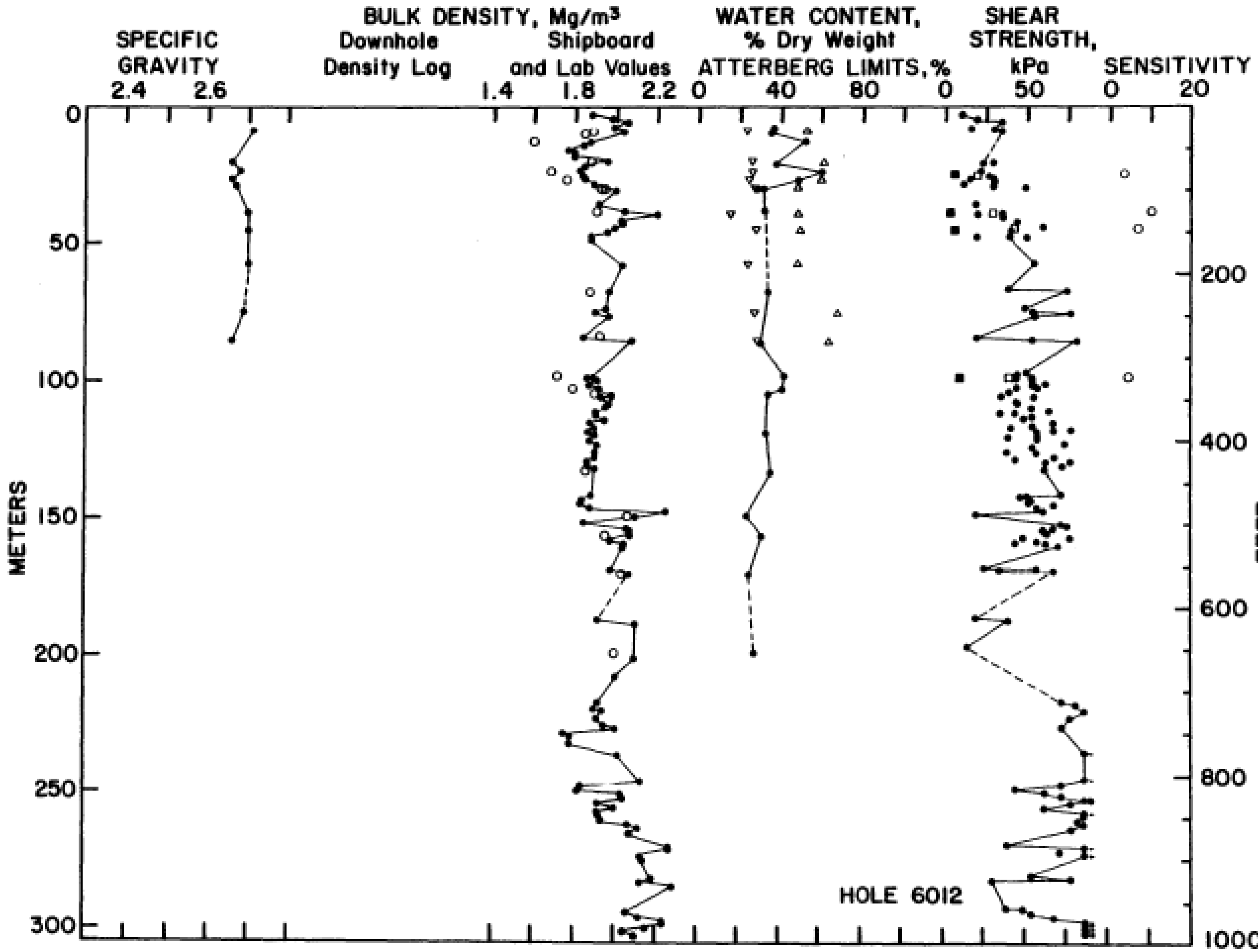
FIG. 5. Compressional sound speed at AMCOR 6012 site. The two curves show the maximum and average bulk densities and the compressional sound speeds calculated using them.

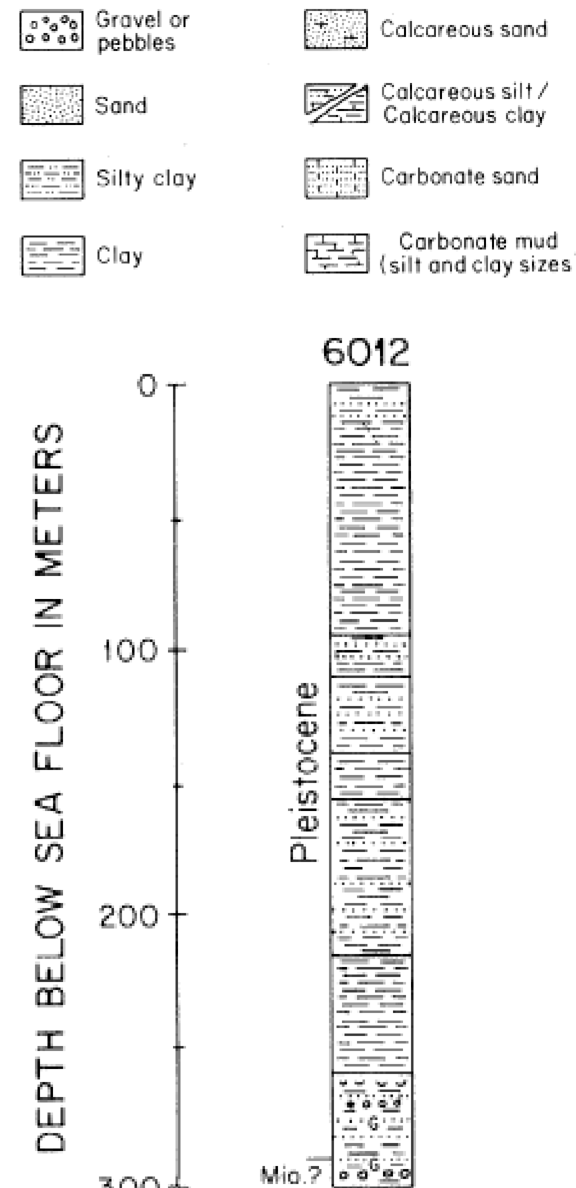


Potty, G., J. H. Miller, J. F. Lynch, and K. B. Smith, "Tomographic inversion for sediment parameters in shallow water," *J. Acoust.* Soc. Am, 108(3), pp. 973-986, (2000).

THE UNIVERSITY OF RHODE ISLAND

AMCOR-6012 Data





THE UNIVERSITY OF RHODE ISLAND

Inversions from Primer

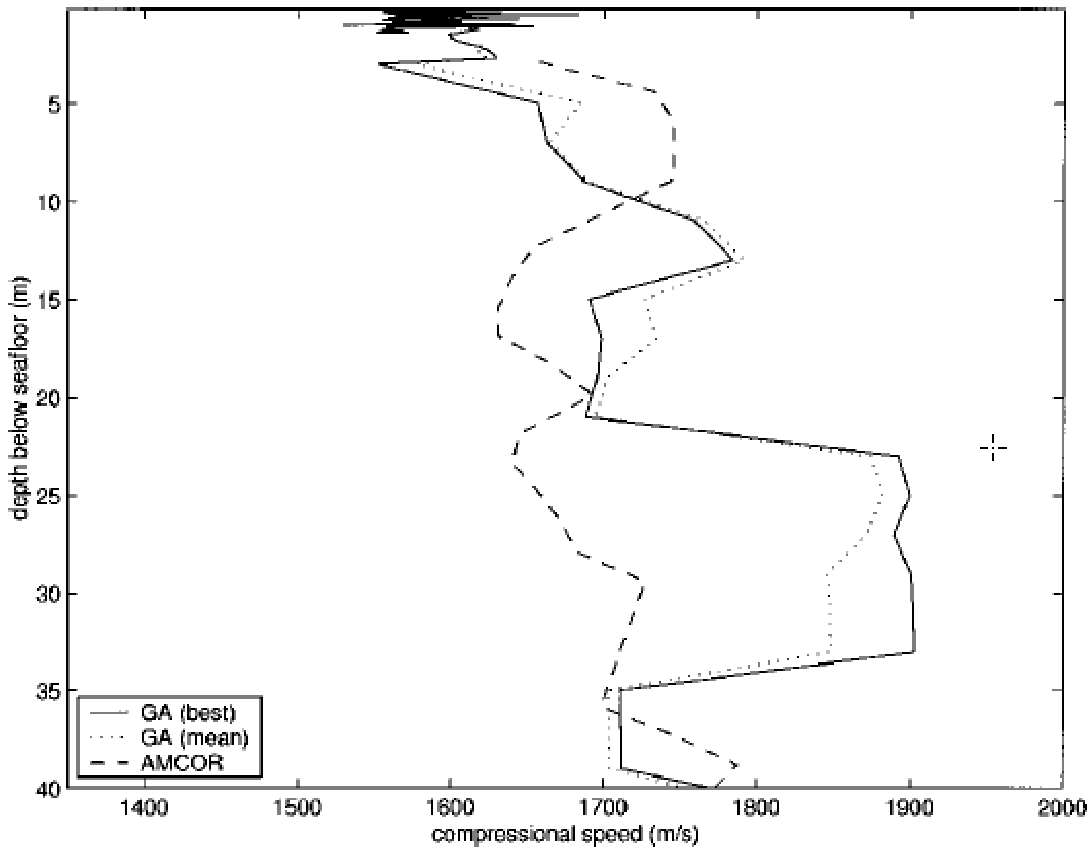


FIG. 16. Sediment compressional speeds obtained by genetic algorithm inversion. The compressional speeds obtained from the gravity cores are also shown in the top 1.4 m of the sediment. Compressional speeds calculated using AMCOR data are also shown. Note the difference between inversion and AMCOR at 3–7-m depth.

Potty, G., J. H. Miller, J. F. Lynch, and K. B. Smith, "Tomographic inversion for sediment parameters in shallow water," *J. Acoust.* Soc. Am, 108(3), pp. 973-986, (2000).

Inversions/Core Logging from Primer

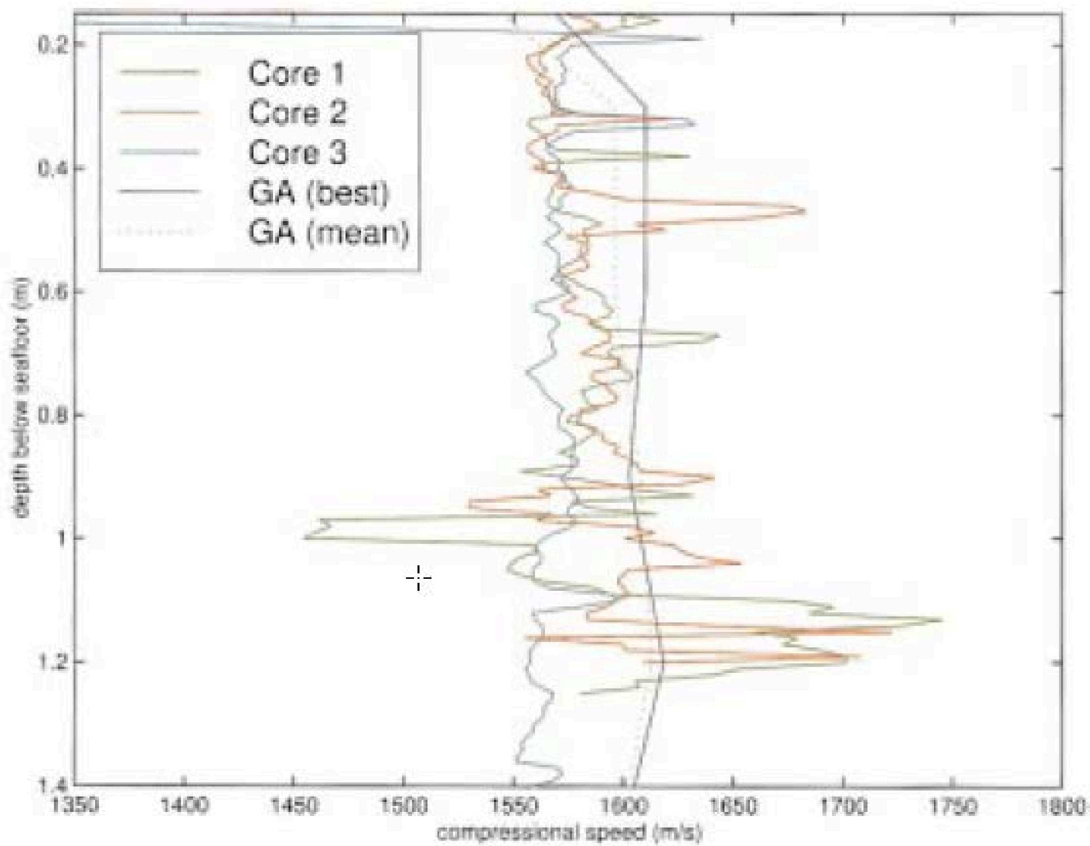


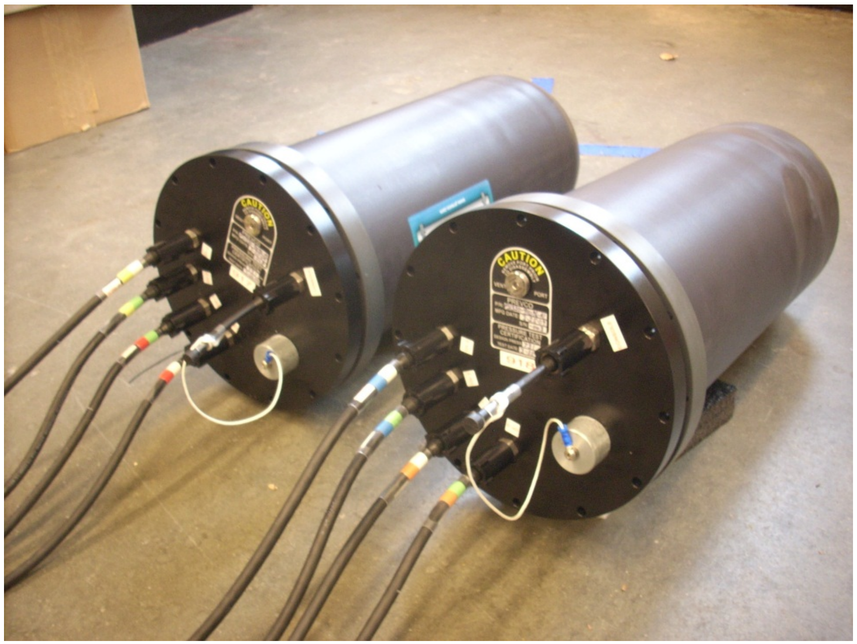
FIG. 18. Sediment compressional speeds for the top 1.4 m of the sediments estimated by genetic algorithm inversion. The compressional speeds obtained from the gravity cores 1–3 are also shown.

Potty, G., J. H. Miller, J. F. Lynch, and K. B. Smith, "Tomographic inversion for sediment parameters in shallow water," *J. Acoust.* Soc. Am, 108(3), pp. 973-986, (2000).

THE UNIVERSITY OF RHODE ISLAND

System Components

Several Hydrophone Receive Units (SHRUs) : 3 Units (12 Channels)



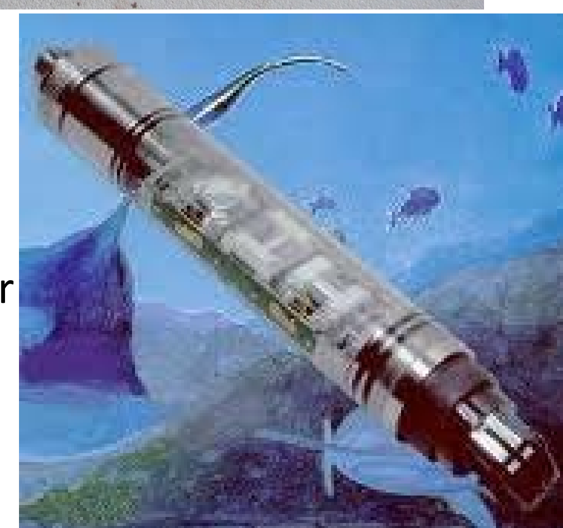
Vertical Geophones (gimbaled) and Hydrophone

(8 Total)

HTI-94-SSQ SERIES -

HTI-94-SSQ Hydrophone (8 total)

Geospace Sea Array 3-axis Gimbaled Geophone (three mutually perpendicular geophones) and Hydrophone **(2 total)**



THE UNIVERSITY OF RHODE ISLAND

Geophone Measurement System

Each SHRU is a 4 channel data acquisition and storage system capable of sampling at 1 kHz or higher. Mission duration can be up to one week using 1 kHz sampling rate.

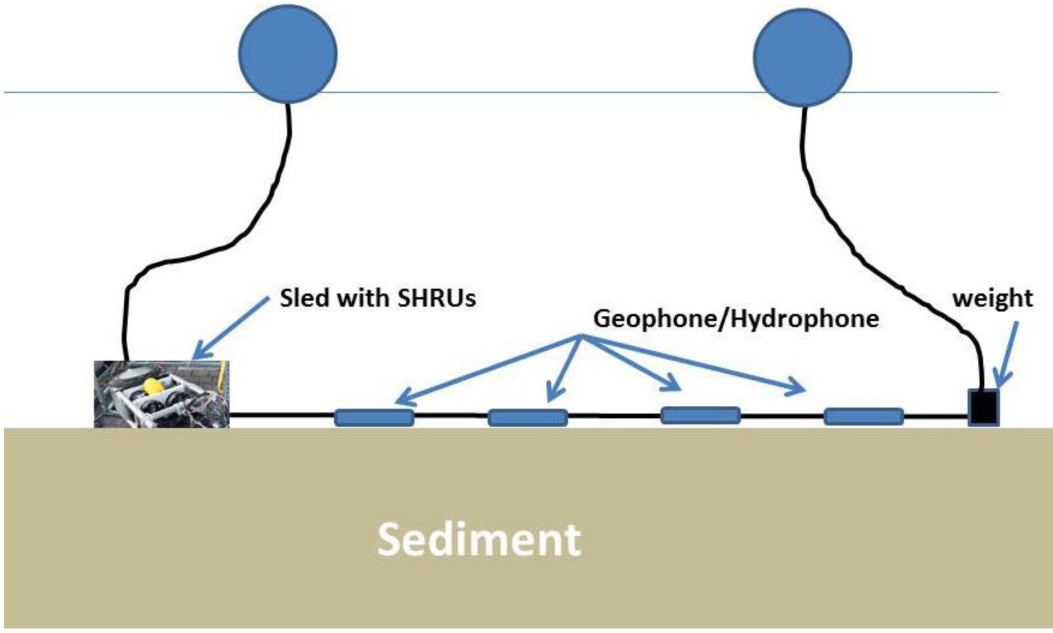
A geophone/hydrophone array consisting of vertical axis and/or 3-axis gimbaled geophones. In addition eight HTI hydrophones are also available.

Sled dimensions: 52" x 30" x 15" ; sled with the two SHRUs weight apprx. 250 pounds

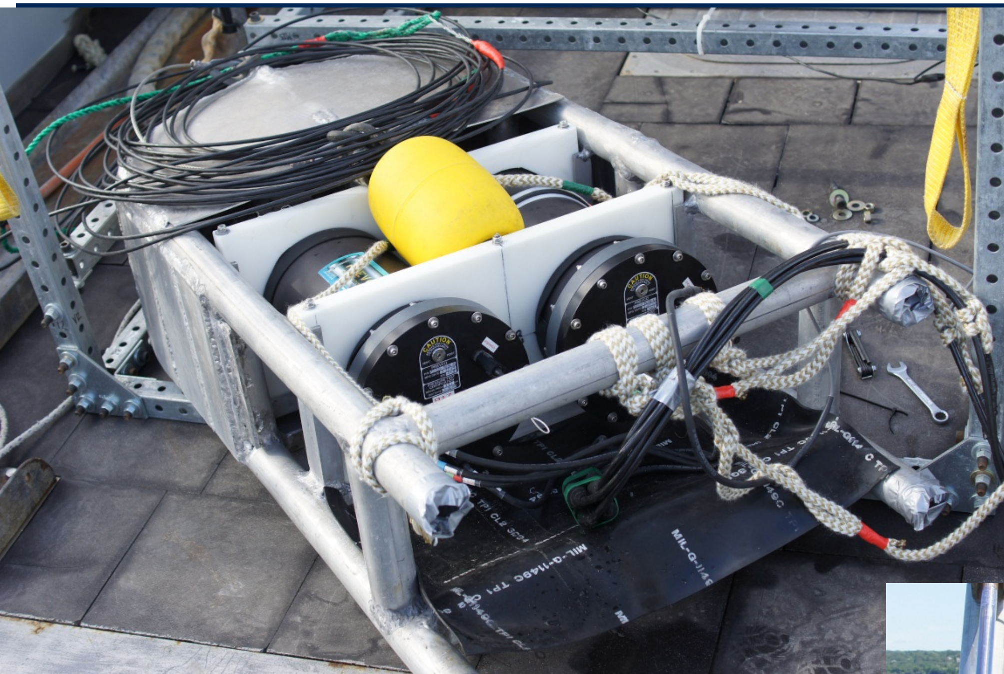
Each SHRU is 24'' long and 11'' in diameter.

Geophones array 35 m long (eight geophones @ 5 m spacing)

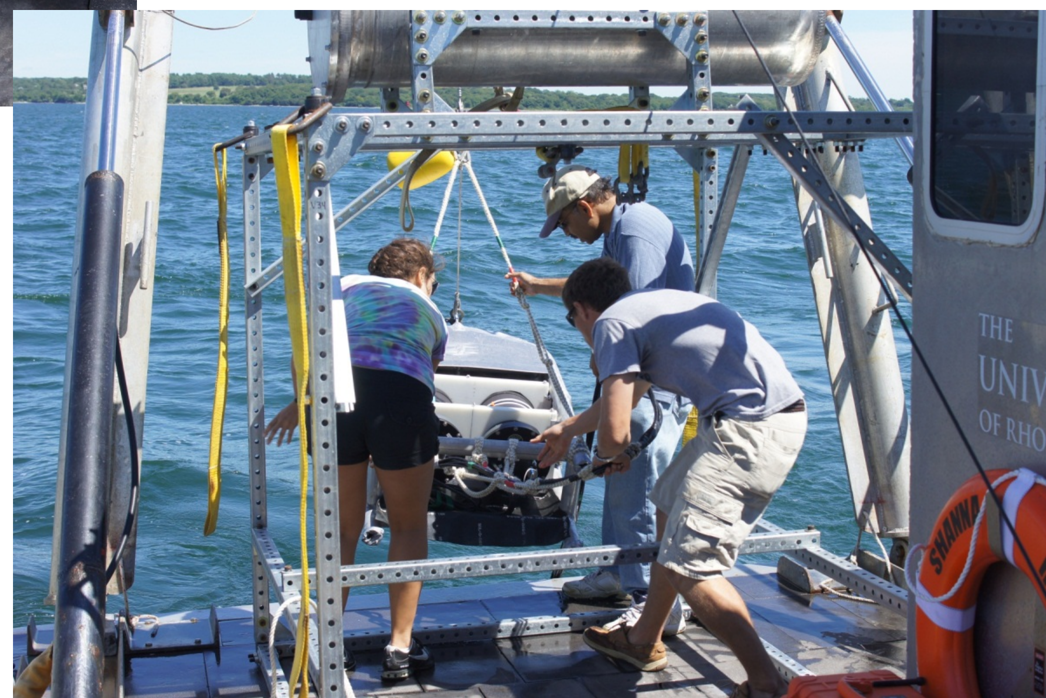
During multiple sea tests using a small R/V, the sled was deployed using the A-frame and winch.



Shear Measurement System



Sled: Houses two SHRUs
The geophone array will follow the sled into the water

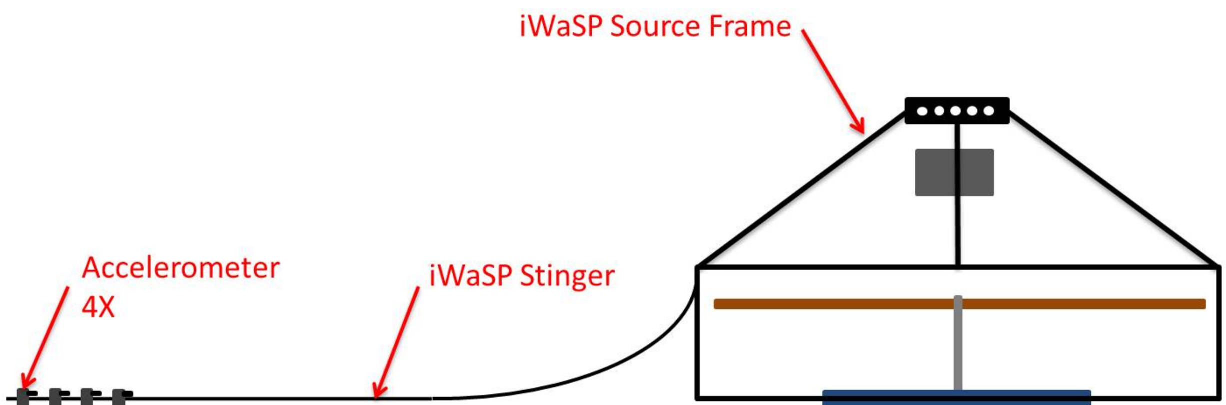


Sled being deployed from R/V Shanna Rose

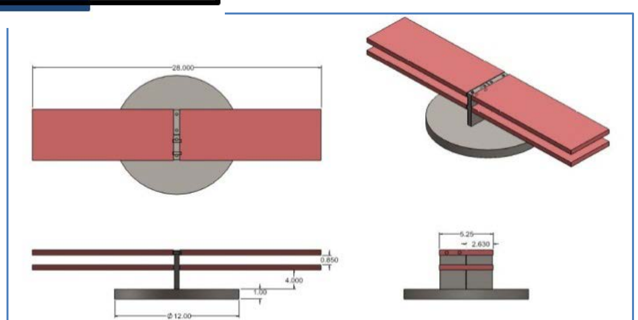
THE UNIVERSITY OF RHODE ISLAND

Interface Wave Sediment Profiler (iWaSP)

- **The proposed new system includes an electronic vibratory source capable of generating interface waves in the seafloor at frequencies up to 1 kHz and a short line array of accelerometers with matching frequency response.**
- **URI, Falmouth Scientific and WHOI (Kemp and Peters)**



Receive array of accelerometers on the stinger



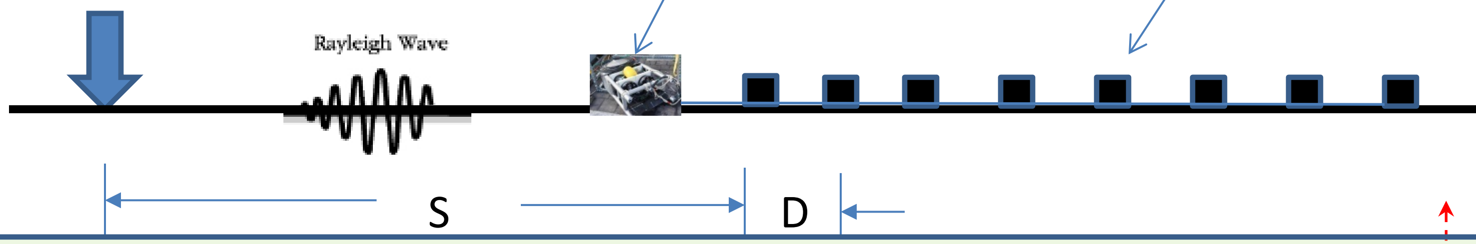
4 beam bender element transducer where the seabed is directly in contact with the vibrator through the circular plate

THE UNIVERSITY OF RHODE ISLAND

Experimental Geometry

D: Geophone spacing (adjustable: ~ 5 m)
S : Source – receiver range (~ 50 m or higher)

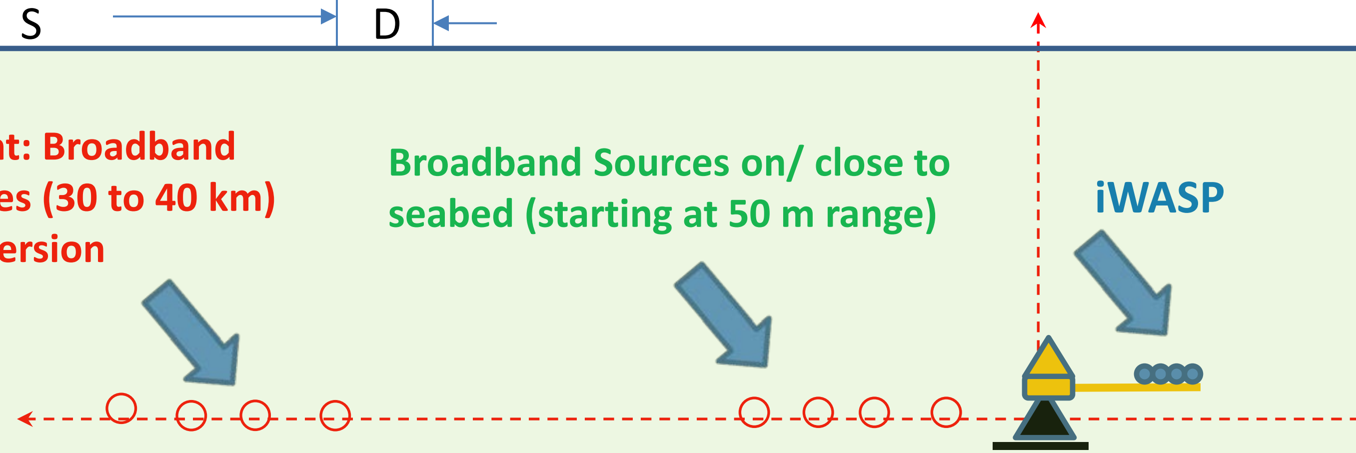
Scholte Wave Experiment



Long Range Experiment: Broadband sources at longer ranges (30 to 40 km) to observe modal dispersion

Broadband Sources on/ close to seabed (starting at 50 m range)

iWASP



○ Broadband source

▲ VLA

— Geophone array

— interface Wave Sediment Profiler (iWASP)

Scholte Wave Inversion: Ambient Noise

Inversion of Scholte-wave dispersion derived from ambient-noise observations

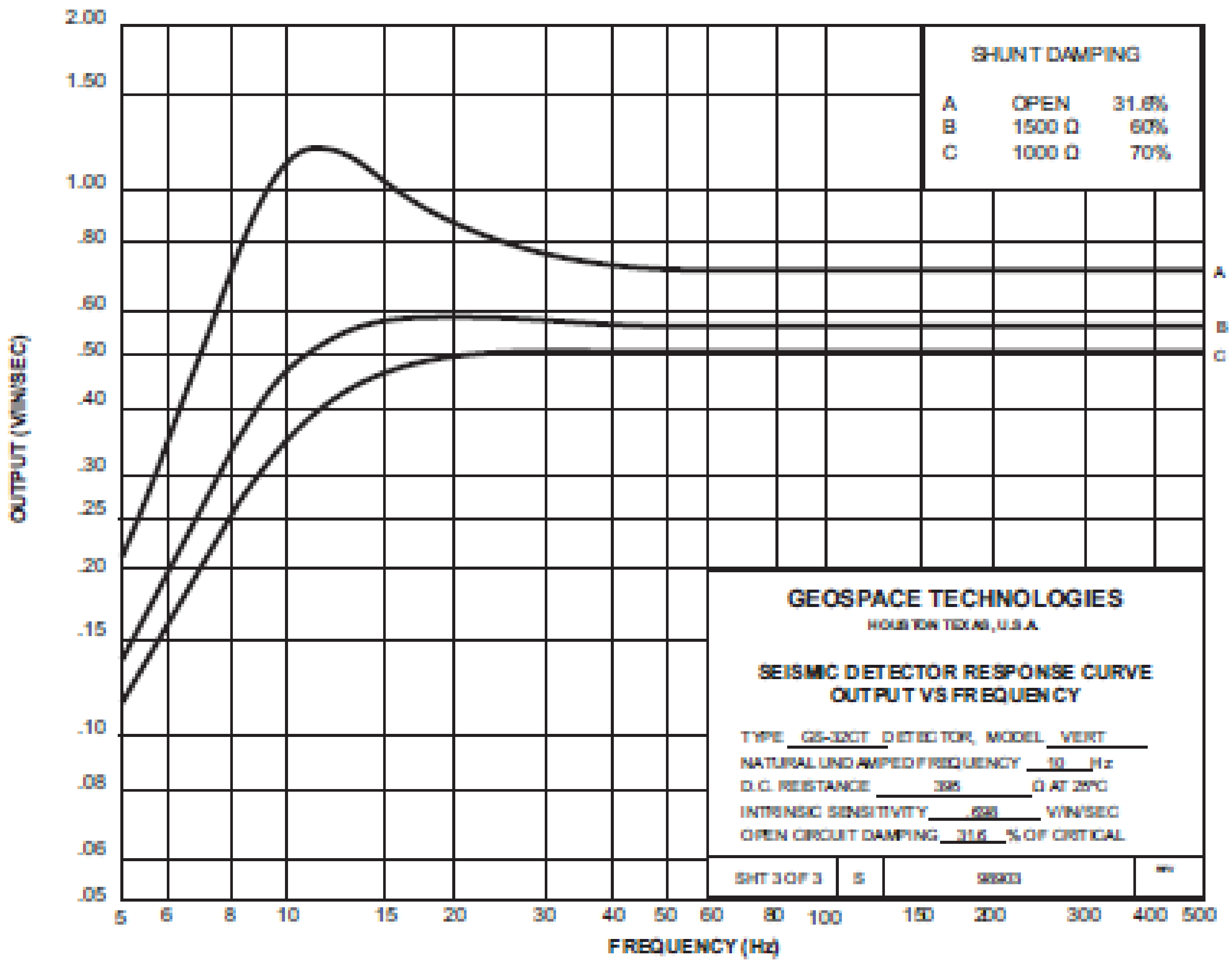
Ambient noise seabed inversion is often based on computing an empirical Green's function from the cross correlation of noise measurements at a pair of sensors

This would require the array recording ship-free noise for at least a few hours.

Cuilin Li, Stan E. Dosso, Hefeng Dong, Dingyong Yu, and Lanbo Liu, "Bayesian Inversion of Multimode Interface-Wave Dispersion From Ambient Noise", IEEE JOURNAL OF OCEANIC ENGINEERING, VOL. 37, NO. 3, JULY 2012

Geophone: GS-32

Geospace PV-1 Dual Vertical Axis Gimbaled Geophone and Hydrophone



2. HTI-94-SSQ SERIES Hydrophone

Sensitivity	with preamp (max) -165 dB re: 1 V/uPa
Frequency Response	2 Hz to 30 KHz
Equivalent Input Self Noise	RMS from 1 Hz to 1000 Hz - 75 dB re: 1 uPa - 0.06 uBar Spectral - 54 dB re: 1 uPa/sq.root Hz @ 10 Hz - 40 dB re: 1 uPa/sq.root Hz @ 100 Hz - 38 dB re: 1 uPa/sq.root Hz @ 1000 Hz
Maximum Operating Depth	20,000 feet (6096 meters)
Size	1.50 inches (3.8 cm) length X 1.25 inches (3.2 cm) diameter