Acoustic Detection of Oil in the Water Column

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Introduction

Capabilities for detecting oil in the water column have relied most heavily on acoustic and, to a much lesser extent, optical technologies, with the latter, generally, being less favoured due to turbidity-imposed limitations on measurement ranges.

Research has been dominated by planned and opportunity-driven field programs, which have tested promising alternative off-the shelf instruments on real or simulated oil and gas plumes.

ASL's own work using our proprietary acoustic technology on near-simultaneous, co-located backscattering measurements carried out on suspended water column targets using four different acoustic frequencies between 125-774 kHz demonstrated that detailed characterizations of suspended particle size distributions could be extracted for suspensions characterized by wide ranges of particle size and particles/volume.

We present preliminary results from tests we carried in July 2018 with ASL's multi-frequency upward looking sonar (Figure 1) at the Bureau of Safety and Environmental Enforcement's OHMSETT Oil Spill Response Research and Renewable Energy Facility outdoor wave tank (Figure 2) using HOOPS crude oil dispersed in saltwater in collaboration with the US Naval Research Laboratory (NRL) and the US Environmental Protection Agency (EPA).

Figure 1. Various deployment configurations of ASL's multi-frequency upward looking sonar.

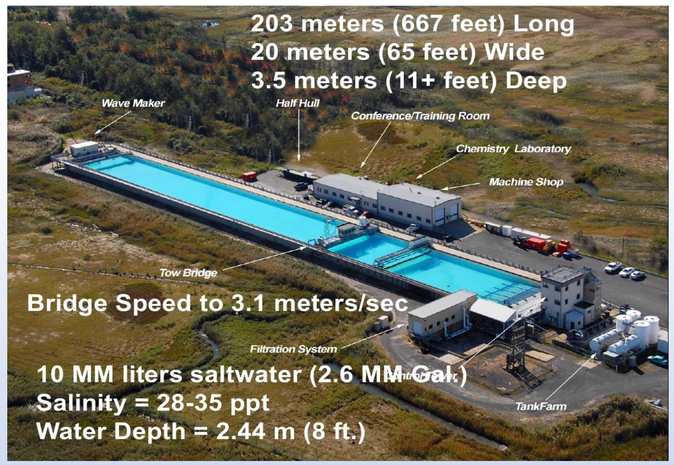

Figure 2. Characteristics of the OHMSETT test tank in Leonardo, NJ. Source: https://www.nrt.org/site/download.ashx?counter=3105

Methods

- Oil was injected at depth above ASL's multi-frequency upward looking sonar (Figure 3).
- Different oil release rates and pressures were used.
- Acoustic backscatter data were collected over four frequencies: 455, 769, 1250, and 2000 kHz.
- Bubbles were also added to the oil releases.

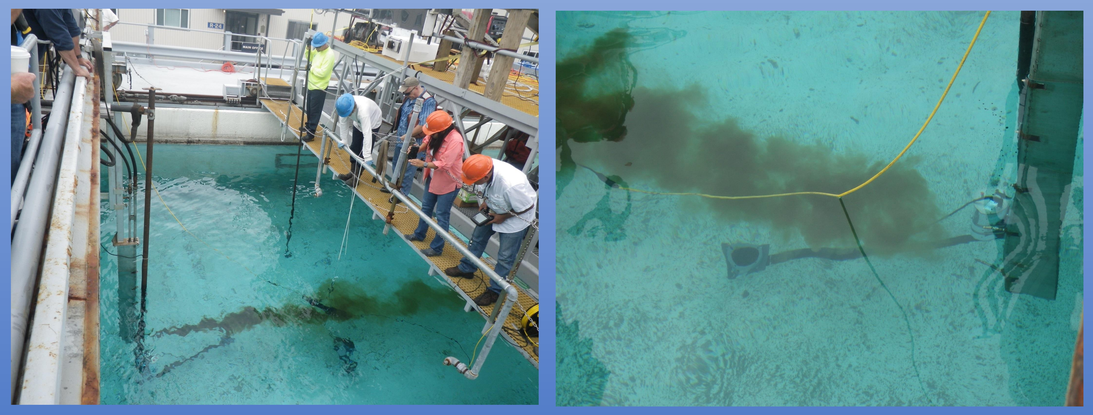

Figure 3. Subsurface oil release over ASL's multi-frequency upward looking sonar.

Results

- Oil was detected acoustically in all four frequencies under all the different release configurations (Figure 4).
- Bubbles were also detected acoustically.
- We are currently in the process of analyzing all the backscattering strength data of all four frequencies used.
- We expect to develop models of oil concentration and oil drop-size distribution to better understand how ASL's multi-frequency upward looking sonar can be used to detect underwater oil spills.

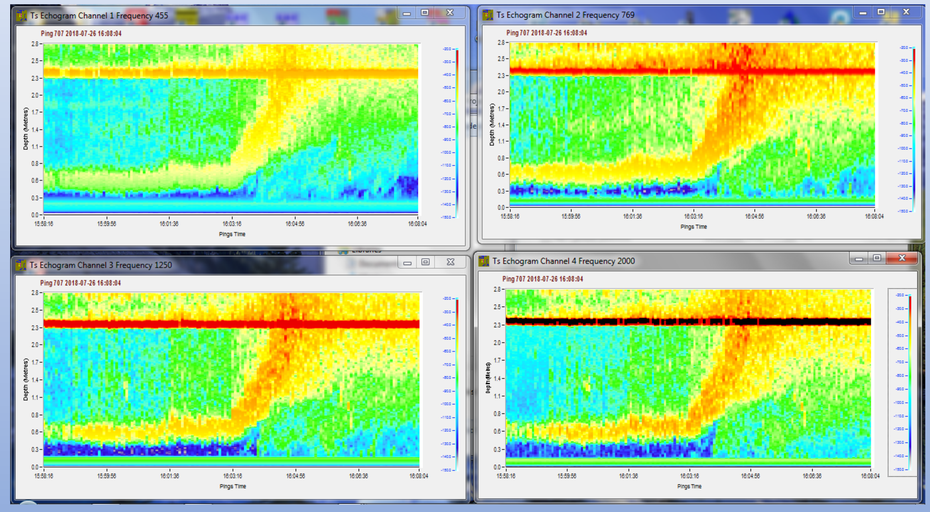

Figure 4. Acoustic backscatter data from all four frequencies (455, 769, 1250, 2000 kHz) during subsurface oil injection.

Acknowledgements

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