

Demonstration of a Passive Seismic-Acoustic Phased Arrays Network on the Littoral Seabed for Monitoring Land Activities

Challenge(s): Determine how well Quantum’s proven land-based seismic-acoustic SADAR®* signal processing techniques can be used to detect on-land energy sources of interest from the littoral seabed. Adapting SADAR® to the littoral environment can make surveilling significant on-land events possible where land access is denied or prohibitive.

Technical Description

- Ocean bottom 4-channel (4C) data acquisition nodes were deployed in array patterns on the littoral seabed to collect seismic and hydroacoustic data, then evaluated SADAR on-land processing techniques using data collected from seabed sensors.
- A SADAR-W (Water) operational prototype system, with sensors and processing software tailored for the application, can later be developed to provide surveillance of activities on inaccessible landmasses near littorals.

Technical Advantages

- Mature (TRL-9) land SADAR® array technology was applied to data collected from the littoral seabed to determine detection performance for seismic-acoustic energy sources of interest on land.
- Ultimately, automated SADAR phased array and network processing can report in near real-time energy source type characterization information derived from specified seismic-acoustic signals of interest propagating within a landmass and its littoral shelf.

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Anticipated Benefits and Applications

Gov’t or DoD:

- Surveillance using passive seismic and acoustic technologies can provide persistent around the clock monitoring that cannot be easily detected or discovered.
- A SADAR-W prototype, once developed, will automatically then be configured for short-term or long-term monitoring and reporting.
- SADAR-W can expand military capability for surveillance and intelligence gathering from denied landmasses near the ocean.

Commercial:

- SADAR on-land is being used to expand for monitoring land-based carbon capture, utilization, and storage (CCUS) reservoirs; SADAR-W naturally applies to CCUS in ocean floor reservoirs, and as a new tool for marine seismic-acoustic research.
- Interest in marketing SADAR-W for the oil and gas industry to monitor fracking and other modern hydrocarbon extraction methods.

Business Model

- The SADAR-W portion of the project can ultimately become a new Quantum product that can stand alone or be integrated into transitional and commercial “solutions.”
- Interested in partnering with industry and academia for further developing performance improvements for SADAR-W applied to specific applications, like CCUS ocean floor reservoirs.
- See adaptation for applications such as security monitoring for potential underwater intruders near valuable assets.

Work to Date

Leveraged 2018 SBIR Phase II:

Quantum developed the capability to automatically extract features of various signals from collected data sets; adapted/applied to analyze performance in this phased array demo project.

Sequential Phase II (Updated 11/11/2024):

- Collected passive seismic data from littoral seabed: Sep 2023-Mar 2024.
- Post-processing full analysis on signals of interest: Apr-Jul 2024.
 - Planned phased analysis reports delivered during analysis.
 - Signal processing optimization analysis DARPA-specified sources.
 - Final Report delivered Aug 20, 2024, to DARPA Small Business Programs Office and DTIC.

