Abstract Submission Form
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Personal Details	
Title:	**Acoustic Vector Sensor Underwater Communications in the Makai Experiment**
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Abstract Details	
Structured Session:	**Vector Hydrophone Research**
Organizer:	**Desen Yang**
Abstract Title:	**Acoustic Vector Sensor Underwater Communications in the Makai Experiment**
Abstract:	The performance of a vector sensor array (VSA) receiving communication signals in the Makai experiment is quantified. Makai experiment was a four-week field experiment, which took place off the coast of Kauai Island, Hawai, in 2005. The data analyzed here refers to the communication test carried out on September 23rd. The VSA is composed of four accelerometer-based vector sensors, which was tied to a drifting research vessel in a shallow water area. A bottom moored source was used to transmit signals from 8k to 14kHz frequency range. The present study explores the VS beam steering method. In this method, pressure and particle velocity channels are weighted-combined leading to a directional gain. The weights are calculated according to the Direction of Arrival(DoA) estimation. A noise normalization step(denoising) is used since the noise power is not uniformly distributed among the pressure and the velocity channels. The communication chain for coherent modulation is composed of synchronization, Doppler tracking, and a single Decision Feedback Equalizer. Bit error rate(BER) performance is estimated for the pressure-only array, a single VS, and the VSA. The analyzed source-receiver ranges(230m and 910m) present a delay-Doppler spread that can achieve 20 symbol intervals and 10Hz. These characteristics make synchronization and Doppler tracking a challenge in coherent modulation. Severe bearing fluctuation issues in the operating frequency and its impact on demodulation are highlighted. It is shown that a single VS may provide similar communication performance comparing to four pressure sensors, which is an expected result that agrees with the vector sensor directional gain. The BER for the shorter range varies from 0 to 5%, depending on the number of sensors used. For the long-range, BER does not achieve values lower than 9%. It is noticed that in a multipath environment, steering to the DoA elevation may not lead to the lowest error for communications.
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