Novel Seafloor Seismic Acquisition Using Autonomous Underwater Vehicles

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Abstract

Objectives/Scope:
Significant engineering efforts have been taken place in recent years to automate receiver deployment and retrieval to conduct cost-efficient seabed receiver seismic surveys. These engineering efforts include industrially engineered seismic seabed sensors (nodes) attached to rope deployment schemes and even robotic nodes, which navigate autonomously to and from the deployment location. This move to automation is inevitable, leading to robotization of seismic data acquisition for exploration and development activities in the oil and gas industry.

Methods, Procedures, Process:
We will present a robotics-based technology, which utilizes autonomous underwater vehicles (AUVs) as seismic sensors without the need for remotely operated vehicles for their deployment and retrieval. In this paper we describe the autonomous underwater vehicle evolution throughout the project years from initial heavy and bulky nodes to fully autonomous light and flexible underwater receivers. Recent results obtained from two field pilot tests using different generations of autonomous underwater vehicles indicate that both the seismic coupling and navigation protocols based on underwater acoustics are very reliable and robust.

Results, Observations, Conclusions:
The objective of this technology is to introduce automation in seafloor seismic acquisition to allow more productive and cost - efficient operations that, at the same time, adhere to safety and environmental regulations. Using this system, flexible acquisition geometries can be employed and seismic data can be collected closer to ocean floor facilities and offshore platforms reducing wavefield illumination shadows without violating health, safety, environment (HSE) guidelines. In this paper, we will present the latest developments of this autonomous seafloor acquisition system. We will demonstrate and discuss with the help of three different AUV vintages test results from a number of field studies emphasizing underwater navigation protocols and seismic coupling characteristics.

Novel/Additive Information:
 This work provides an in-depth analysis of the current AUV development for seafloor seismic acquisition. This is a novel seismic acquisition technology, the first in the industry, which employs a large number of AUVs as seismic sensors. It is a game changing technology with the objective of providing robotics solutions to automate seafloor acquisition.