3D Marine Seismic Survey Planning

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Introduction

3D marine seismic data is often collected using a purpose built seismic survey vessel towing dual acoustic source arrays and hydrophone cables (also known as streamers). The seismic vessel will traverse the survey area in a series of pre-determined lines at a speed of approximately 4-5 knots. The acoustic emissions from the source arrays will be detected by the hydrophone cables and recorded onboard the vessel. The reflected sound is then processed to provide information about the structure and composition of geological formations below the seabed. Survey planning and design is of the utmost importance in 3D marine seismic data acquisition. Survey design depends on so many different input parameters and constraints that it has become quite an art. Laying out lines of sources and receivers must be done with an eye toward the expected results. Unlike other geophysical surveys, the 3D seismic acquisition parameters are hard, and often time consuming and costly, to change mid-program.

Most Influential Factors

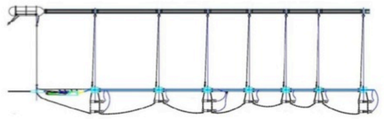
1. Initial considerations
   - Objectives / survey goals
   - Financial issues – days funded
   - Time constraints
2. Survey Layout and Geometry
3. Source Equipment
4. Recording Equipment
5. Arrays
6. Practical Field Considerations

Survey Layout & Geometry

The Principal Investigator (PI) for the 3D seismic survey decide the layout of their survey area. The PI works with LDEO Office of Marine Operations Technical Service Group to decide the best way to configure (Setup the Geometry) the array to acquire the PI's objectives in the most time efficient manner. Throughout the mission the Chief Science Officer (CSO) works with the PI to make real time adjustment to the acquisition plan to so as to make use of the time given by the funding agency and insures that there is sufficient volume of quality data for the PI to analyze to satisfy the goals of the survey.

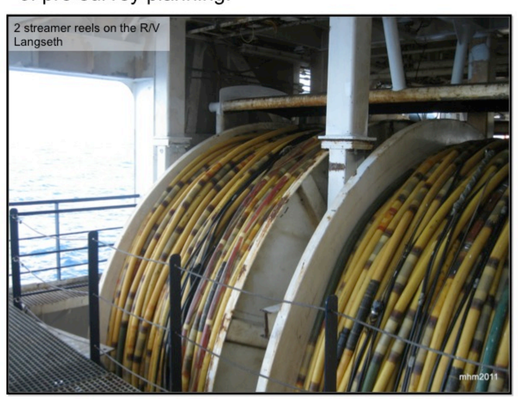
Source Equipment

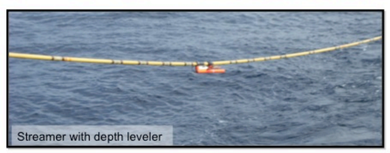
The 3D source arrays usually have a total volume of less than 3500 cubic inches and will be towed at a set depth specified by the PIs (for example, 9 meters) based on the survey goals.



Recording Equipment

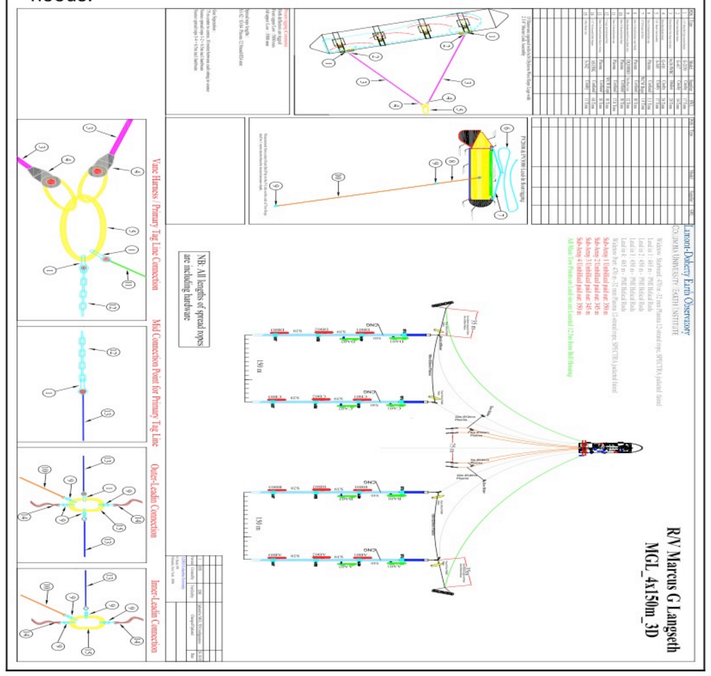
The vessel will tow hydrophone (recording) cables called streamers, which will be up to 6 km long. Depth levelers on each streamer can maintain them to a desired depth (3 to 20 m). A head, mid, and tail network will be configured into the system to aid in accurate positioning. Streamer depth is a function of sea water temperature and salinity which greatly affect buoyancy. In warm, high salinity waters, more weights are necessary to trim the streamers than in cold, low salinity waters. Proper trim is a very important to the survey and takes a lot of pre-survey planning.





3D Array

This is a drawing of a typical 3D array the R/V Marcus G. Langseth deploys on a mission. Deployment time can range from 24 to 72 hours or more depending on the amount of work the array and streamers needs.



Field Considerations

- Weather - Time of Year
- Currents
- Ship Traffic
- Water Depth
- Marine life - implement a range of mitigation and management measures to ensure potential environmental risks are appropriately addressed during the survey

Contacts

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