

Sea Mine Surveying in Southern Africa

This article summarises the surveying activities of a private offshore diamond mining company in Southern Africa, De Beers, who pioneered underwater diamond exploration and liberation in Namibia and South Africa. Surveying is one of the integral core support services required for efficient mining in the offshore environment. The author describes the mining company, explaining how the survey department is integrated with the remainder of the company and what survey equipment is used for the mining of diamonds underwater.

De Beers Marine (PTY) Limited was founded in 1983 as the successor to earlier De Beers Group marine operations. The aim of the company is to provide the expertise for exploration of deep water diamond deposits at sea and to achieve this the company operates a fleet of vessels. There are workshops, stores and administrative offices at the Cape Town company base which support its offshore operations. De Beers Marine Namibia (PTY) Limited is based in Windhoek and provides support for the fleet of mining vessels that conduct mining operations off the Namibian coast.

One of the strengths of the companies has been the ability of the technical staff to develop undersea mining technology by adapting existing equipment for use in deep water environments.

In the field of offshore support platforms, the search is for suitable vessels upon which to accommodate and deploy various systems. This may well entail the construction of appropriate vessels. Current thinking is inclined towards self-propelled units, as these offer a more mobile and safer option in the typically rough conditions off the west coast of southern Africa.

De Beers Marine continues to enhance its data acquisition and interpretation systems to improve the speed and accuracy with which deposits can be located and evaluated.

Survey Department

The De Beers group survey structure is in line with group policy and the surveyors from different disciplines and mines interact via Corporate Head-quarters to provide a service to individual mines.

The whole exploration and mining operation relies for De Beers Marine companies upon the surveyors, who provide accurate positioning for all the vessels and their mining tools; the diamond deposit is then depleted according to the areas covered by the mining tools.

Accuracy is of the utmost importance but is dependent on available technology - better accuracy improves the efficiency of the mining.

The vessel positioning systems are largely self-sufficient and are monitored remotely from the offices. To support this, a three-tier survey audit process is conducted. There is a team of seagoing surveyors who ensure that the vessel systems are fully functional. The operation of the remotely-operated vehicles is more complex; underwater acoustic positioning systems are used and full time surveyors are in attendance. Higher level audits are conducted regularly at sea and in the office. All data is audited again before commitments are made to changes in the diamond deposit.

Surveyors are also involved with new projects and the implementation of new systems.

Survey Equipment

For positioning, the vessels use a number of sensors that are integrated by a Quality Assurance / Quality Control system. The sensors used include: Global Positioning System (GPS), Various GPS Differential correction systems, Motion Reference Unit, Gyro, Acoustic Positioning System and a Swathe Bathymetric System for Seabed visualisation.

For Geotechnical data acquisition, an Autonomous Underwater Vehicle is used where similar systems architecture is employed. Additional sensors on the AUV include: Doppler Log, Interferometry Swathe System, Side Scan Sonar and Pinger sub-bottom profiler.

As an offshore mining company, De Beers Marine considers it preferable to concentrate on core business. Contracting survey services is considered and assessed against quality and economic criteria. Certain services are contracted out and this trend is likely to continue in the future.

Monitoring of Mining

High resolution Side Scan Sonar and Pinger sub-bottom profiler systems are used for pre-mine surveys and geological analysis. During mining, a vessel-mounted swathe bathymetric system is used for seabed surveys and visualisation. These systems provide information to ensure that the area is adequately covered and that any obstacles are avoided. Mining is also constantly monitored in terms of Geological expectations and Mining and Metallurgical parameters. This information is reported and analysed regularly. If necessary, Post-Mine surveys and audit sampling are conducted in areas of unusual geological or mining conditions.

Legal Aspects

One of the complexities facing international offshore mining companies is the array of applicable legislation to be taken into account. De Beers Marine does not own any mining or prospecting concessions but has entered into service agreements to exploit concessions owned by its clients. In the countries where the companies operate, these concessions have been awarded in terms of applicable legislation. The countries concerned are signatories to the United Nations Conference on the Law of the Sea and as such observe the terms of this convention.

De Beers Marine complies with the relevant national legislation that governs the mineral resources of the country. Offshore concessions need to be defined in conjunction with the local authorities if necessary and the appointed responsible surveyors ensure that the statutory survey requirements are complied with for these concessions.

Hydrographic Surveying in Africa

The offshore industry in Africa covers a broad spectrum that includes oil and diamond mining and international survey companies use Cape Town as a base for their African operations. Surveyors with recognised survey qualifications are recruited and trained in the specialised aspects of survey required. The diamond mining operation is unique and although survey philosophy and practice is common, some of the technology and techniques are special to offshore diamond mining.

The South African Hydrographic Society has representation from a large variety of people and companies interested in matters maritime. Membership is open and there is no categorisation. The society supplies a networking venue for technical, academic, philosophical, practical and commercial discussions for the offshore industry. This society was very active in the past but had become dormant. A committee was formed to modernise the objectives of the society and to align itself with current requirements of the offshore community. This year, the Society has regained itâ€™s vibrancy, illustrating the fact that the offshore industry has evolved into a technically advanced and challenging work environment that is fun to be a part of.

<https://www.hydro-international.com/content/article/sea-mine-surveying-in-southern-africa>
