

MARINE SURVEYING AND POSITIONING TECHNIQUES : ITS APPLICATION TO OCEANOGRAPHIC SURVEYS

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Any measurement or observation in oceanographic studies needs to be located (its position fixed) unambiguously with reference to a properly defined map, co-ordinate system. The degree of accuracy commensurate with objectives of the particular study or exploration programme being undertaken. In brief the offshore activity demands a greater accuracy in positioning and mapping and thus these areas involve the Marine surveying techniques.

These are three major differences between surveying on land and positioning at sea.

1. In the absence of easily distinguished land mark at sea to which the observations and sampling stations are referred, needs to understand the techniques of establishing the shore reference stations to provide the geodetic control for the offshore surveys.
2. Observing station is not stationary as on land but is moving on a survey vessel this motion is a translation of several metre per second with oscillations superimposed on it. Due to this motion there is a need of position fixing system which can provide a continuous indication of position and change of position which is not necessary on land. Because of this motion the accuracy obtainable at sea is much less than on land.
3. On land we have our feet on topographic surface and attempt to determine how far above we are from MSL and at sea, we determine how far below us the topographic surface is.

ESTABLISHMENT OF GEODETIC CONTROL

Keeping in mind the above points the geodetic control points are to be established on the land and to use them as a reference station for offshore positioning.

The National Surveying Authorities survey stations for which site descriptions and co-ordinates are provided are used as a reference system. Once the base and azimuth is obtained from the above stations a network of triangulation, trilateration or the traverse was run depending upon the limits of survey area by using the theodolite, tellurometer or distomate, keeping the following points in mind.

- i) The selected location must give good coverage of the survey area.
- ii) The location should be easily accessible.
- iii) Geometry of the survey area (the angle of intersection of the ranges must be between 30 and 150)

Where ever the National Survey authorities survey stations are not available. The base and azimuth can be found by using the Tellurometer and Astronomical

observations for extending the triangulation chain. Satellite (NNSS, GPS) are also in use to fix these reference points.

On completion of angular or distance measurements the process of translating these measurement into coordinates and in turn production of map on which all offshore positions can be plotted starts. Before constructing a map one has to devise some scheme whereby the curved surface of earth can be represented on a flat piece of paper. This process is known as geographical map projection. Some of the projections are i) Mercator ii) Transverse Mercator iii) Gnomonic iv) Lambert conical orthomorphic v) Stereographic projection.

POSITIONING AND POSITION FIXING TECHNIQUES

Before the selection of offshore positioning system we should know about marine positioning accuracies.

There are two accuracy parameters.

- i) Relative accuracy
- ii) Absolute accuracy

The problem of position fixing at sea increases with distance from land. It is therefore proposed to divide the navigation equipment on the basis of positioning requirement.

- i) Visual or conventional Method (Sextant, Theodolite)
- ii) Radio navigation system (Range-Range, Hyperbolic)
- iii) Satellite navigation system (Navigation or G.P.S.)
- iv) Acoustic navigation system

BATHYMETRIC DATA COLLECTION AND PRESENTATION

Besides providing answers to the selection of position fixing system for a particular task a survey of seafloor topography is also essential in thinking about the exploration. Measurements of topographic variation of the seafloor are presented as bathymetric chart. The work of the hydrographers is to delineate the bottom topography with primary purpose of navigation and scientific investigations. This implies the observation of precise depth and location.

Echosounders are used to make discrete measurement of depth below floating vessel and from profiles of such measurement the topographic map of the seabed is constructed.

Echosounder is calibrated against a bar check before the survey. An event mark is simultaneously given to mark the position and depth.

The depth obtained are influenced by the stage of tides.

The water level (i.e. tides) must be observed relative to a fixed mark ashore to obtain the necessary information enabling us to reduce the recorded depth. A tide pole or the automatic tide-gauge is installed for recording the

tide. These tidal recording means are linked to chart datum (which is lowest astronomical low water). Thus the recorded depth are corrected for tidal influence. A graphic curve against the time and height is constructed to reduce the depth to the chart datum. All these information are used to prepare the topographic map.

CONTOURING

To obtain the topographic information the contours are drawn for which the recommended values in metres are 0, 2, 5, 10, 20, 50 etc.

Use of bathymetric information in oceanographic surveys :

On the basis of bathymetry of an area a morphological map is constructed. The morphology of the area is helpful in understanding the seabed geology. The quantitative data on the shape of bottom feature, is helpful for offshore engineering problems.

Bathymetric maps are also useful for studying the sealevel fluctuations :

References for further reading:

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