

MARINE SURVEY TECHNIQUES : A PREREQUISITE FOR EXPLORATORY FISHING

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Offshore exploration, exploitation of the resources form a new and rapidly growing field of industrial development. A knowledge of the topographic configuration of the survey area is a basic to these development and methods used to acquire this knowledge is important to all who are either professionally involved or training for such an involvement.

Keeping in veiw the topography of the sea floor is an essential tool for almost every exploration or exploitation program therefore the required data has to be collected either in advance or at the time of other data collection. Results are usally presented in the form of Bathymetric Chart. The term 'Bathymetric' chart is in general use for a range of charts showing measurement of topographic variation on the sea bed. Like any other topographic map, it is important to note the datum to which measurements are referred. In order to prepare a bathymetric chart, time, tide, position and depth must be measured simultaneously. These measurement are made continuously from a survey ship/boat sailing along a predetermined known as sounding line.

To prepare a bathymetric chart, the following three parameters have to be determined.

In standard type of echosounders, the depths of the water are recorded by the following device:

Driven by a motor, an endless belt of synthetic material is moved at constant speed over dry recording paper, from top to bottom. Simultaneously the paper moves from right to left. It tends to become black whenever an electric current travels from the front of the paper to the conductive back. The recording belt is provided with a stylus consisting of a thin special wire. With its tip it smoothly moves across the paper for current supply the opposite end of this stylus slides on a recording rail connected to the amplifier. On the endless belt there is a releasing magnet which releases a sound pulse via transmitting device whenever the stylus moves past the scale zero point. Via the stylus transmitting pulses and echoes record black marks on the nearly white paper, adding up to produce the profile curb of the sea bottom and all the reflectors in the water between surface and bottom, such as fish. In short a pulse of sound is emitted by the sounder and an echo from the seabed detected. The returning echo triggers an electrical pulse which makes the stylus "burn" a mark into the paper creating the bottom trace on the echogram. The time interval between transmission of pulse and detection of the echo is measured.

All sonars have got the some of the following basic components.

1. a pulse generator, to provide electrical power
2. the switching unit, to pass this power to the transducer
3. the transmitting transducer, to convert the electrical power to acoustical power and project acoustical power into sea water medium.
- * 4. the receiving transducer, to receive reflected sound power and convert it into electrical signals.
5. the receiving amplifier, to step up the amplitude of the very weak echoes to enable them to activate the recording system.
6. the recorders, which usually controls the emission of electrical energy to the transducers, times the interval between transmission and reception of the acoustic pulse, converts the time interval to range and presents the resulting data for the users convenient.

* Nowadays one transducer acts as transmitter and receiver. The transducer transmits when the stylus passes the top of the echograms paper (Transmission mark zero) the travelling speed of the stylus is proportional to

- twice the speed of sound in water.
- the scale of the echogram paper.

Calibration:

The speed of sound in water and thus the depth measured is influenced by the temperature and salinity of water. To use the correct speed survey echosounder is to be calibrated by means of a bar check.

The modern echosounders are distinguished between two types:

1. Single beam echosounder
2. Swath Sounding system

position fixing techniques (afloat):

A position (or fix) is the point given by the intersection of two or more lines of position (LOP). A LOP is the line connecting all the points where the positioning system renders a constant value (normally each system consists of many such values). Line of position can be straight lines, circles (distances), hyperbola etc.

The need of position fixing at seas arose over since man started sailing for fishing commence, trade or even warfare. The exploration and exploitation task needs the higher accuracy and led to better methods of position fixing.

The problem of position fixing at sea increases with the distance from the shore. In the vicinity of the coast, fixes can be obtained from shore objects, but with the increasing

distance from the shore reliance has to be placed on other methods such as radio positioning with increasing range even the accuracy of radio positioning system deteriorates. It is therefore, proposed to divide position fixing requirement into different arbitrary Navigational Zone (Table I).

TABLE I
NAVIGATION ZONES

Zone	Range	Representative Depths
Inshore	0 - 30 km	40 m
Coastal	30 - 150 km	100 m
Offshore Zone	150 - 1000 km	200 m
Deep Sea	1000 ---->	-

(The representative, depth has been included since the requirement is often depth dependent and the accuracy of some navigation system is depth dependent. The range depth correlation is based on arbitrary considerations.)

We have to keep in mind:

1. What are the positioning requirement (what accuracy desired)
2. What are the capabilities of various presently available systems, and how well do these satisfy the requirement.

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

There are two accuracy parameters; relative accuracy and absolute accuracy. Relative accuracy or repeatability, defines the capability of locating that point relative to a reference point or a co-ordinate system. Relative accuracy figures may be valid over long periods, or only over a short periods. Usually long term relative accuracy is implied defining the confidence with which one can return to the same point at any time in the future. Short time relative accuracy is a less stringent parameter defining the confidence with which sequential position fixes can be used to determine vessel movement.

For tasks which require only the velocity of the ship, the accuracy parameter of interest is short term relative accuracy.

For tasks in which the same navigation system in the same configuration will always be used the long term relative accuracy parameter is of interest.

For tasks providing information of value to others who may use different means of navigation the absolute accuracy parameter is of interest.

One other parameter is often mentioned is the resolution or precision of which a system is capable. Accuracies will,

of course never exceed the value of this parameter. Since resolution is only one factor degrading accuracy, it usually bears little relation to achievable accuracies.

As has been explained above the problem of position fixing at sea increases with distance from the land. It is therefore proposed to divide the navigation requirement on the basis of positioning requirement.

1. Visual or Conventional Method (sextant, Theodolite)
2. Radio Navigation Systems (short range, medium range, long range)
3. Satellite Navigation System (NNSS, GPS)
4. Acoustic Navigation System

Tidal correction:

The depth measurement from ship are made with reference to a sea surface level which rises and falls in response to varying tidal conditions. It is therefore essential to relate these depths to a datum plane. This datum plane is different from the one to which heights are referred on land. This datum plane is generally known as chart datum.

If the tidal station exist in the survey area then we can make use of the daily tidal readings from the Automatic tide gauge. If not a tide pole has to be established and linked to a nearby bench mark. Thus the raw depths are corrected for the tidal oscilations and all charted depth are

brought to a plane known as chart datum. In other words any stage of tide this will be the minimum depth available in this location.

Contouring:

Contouring is an excellent means to obtain the topographic information of the sea floor which in turn will be useful to study the morphology of the survey area.

The sheet prepared in this way, which shows the coastline or prominent coastal features, the depths reduced to chart datum and depth contour lines, is the source material to prepare the bathymetric chart.

Uses of bathymetric chart for exploratory fishing:

The topographic configuration, (bathymetry chart) and accurate positioning are the basic and useful tools for the exploratory fishing. The knowledge of depth of water in the given location is of the utmost importance in the field of fisheries. The existing mechanised fishing operations in the Indian shelf are largely confined to shallow depth but with the expansion of fishing fleet and extension to deeper area, accurate bathymetric chart with a position fixing system will be of immense value. More over the echogram will be the cheapest and quickest way to have a general information about the nature of sea bottom. This will be an important cheaper aid especially for trawling purposes.

There is a need to prepare fishery charts or the atlas containing the depth, topography configuration, nature of bottom, general fisheries biology. As most of the fish concentration depend both on depth of water and location (distance from coast). Moreover each of the truly demersal fish species are choosy about the particular nature of bottom perhaps due to the reason of quality of food in the bottom. The benthos-varies considerably in quantity and in species composition from one type of bottom to other depth of water and hydrographical condition close to bottom. In addition to above the precise knowledge of the type of bottom allows quantitative and qualitative estimates to be made of the benthos communities in any particular or chosen locality. It is strongly recommended that systematic National fisheries charts should be prepared for economic exploration of fishing in the EEZ of our country.

Suggested Readings:

1. Sea Surveying - ed. A.E. Ingham, 1975, Part I & II - Johan Wiley & Sons, London.
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4. 'The Principles of Navigation' Anderson E.W. Hollis and

Carter, London.

5. Clark, D. (1969). Plane and Geodetic Surveying for Engineers (Vol 1) - Plane Surveying Chapter XII hydrographic Surveying Constable, London.
6. Doodson, A.Jj. and Warburg, H.D., 1941. Admiralty Manual of tides. (Her Majesty's Stationery Office, London).