Newsletter – *October 2015*

ASB Systems Pvt. Ltd.

Living the Multi-dream

There is no doubt that the Multibeam echosounder is an amazing piece of equipment.

But when it comes to choosing one for the job, there is this one suitable Multibeam….until it is realised there are several other suitable Multibeams!

There's the portable one, the compact one, the variable frequency one, the one with an amazing coverage, the one with motion stabilization, the one with sidescan, and even the one which claims to meet IHO standards! Ahem…the last one pretty much being an audacious claim, as a lot depends on the peripherals and system calibration.

In addition, there are those Beamforming and Interferometric techniques implemented by different manufacturers, with each claiming to surpass the other.

While every manufacturer is "Multi-keen" to supply his Multibeam, here we are again, "sounding" the bugle on the "what's what" in Multibeam echosounder technology.

In this issue…

A multibeam echosounder is a device typically used by hydrographic surveyors to determine the depth of water and the nature of the seabed. Most modern systems work by transmitting a broad acoustic fan shaped pulse from a specially designed transducer across the full swath acrosstrack with a narrow alongtrack then forming multiple receive beams that are much narrower in the acrosstrack.

Development of Multibeam echosounder:

Multibeam sonar sounding systems, also known as *swath*, originated for military applications. The Sonar Array Sounding System (SASS) was developed in the early 1960s by the US Navy, in conjunction with General Instrument to map large swaths of the ocean floor to assist the underwater navigation of its submarine force.

As the cost of components decreased, the number of multibeam systems sold and in operation worldwide has increased significantly. Smaller, portable systems can be operated on a small launch or tender vessel unlike the older systems that required considerable time and effort to attach to a ship's hull.

Multibeam data allows the surveyor to chart many different aspects of the ocean floor:

- Depth can be shown as plots of selected soundings, as contours, or as colour-coded charts.
- Seabed shape can be realistically depicted as a shaded relief model.
- Slopes can be precisely measured and mapped to allow engineers, for example, to analyse seabed stability.
- The type and distribution of sediment and rocks can be gauged by recording the strength of the returning echoes (called backscatter).

Differences between Beamformers and Interferometers:

The differences between these two methods have to do with the way the Angle-Travel Time pairs are determined. A **Beam Forming System** determines the Travel Time as a function of Angle (thus excluding the possibility of different travel times corresponding to a single angle)

An **Interferometric System** determines the Angle as a function of Travel Time (thus excluding the possibility of different angles corresponding to a single travel time).

Differences between *Amplitude* and *Phase* detection methods:

- *Amplitude detection* relies on finding the travel time of an echo's interception with the bottom. Typically determined using center of mass method. (Similar to single beam depth measurement methods).
- *Phase detection (Interferometric technique)* relies on finding the phase shift at two subsections of the transducer receive array.

An intelligent Multibeam echosounder such as the Teledyne MB2 has "Auto cross over" feature from amplitude to phase dependent on the quality of the returned signal. This reduces phase/amplitude crossover artifacts and results in improved data quality.

In comparison, Beamforming is considered to be a more robust process in complex environments such as ports and harbors., and is a more widely accepted technology than Interferometry.

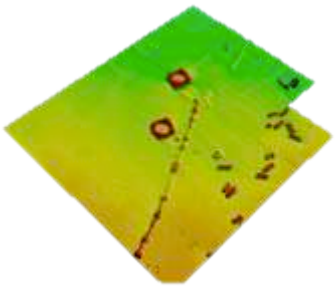
Teledyne Marine is a group of leading-edge undersea technology companies and has evolved into an industry powerhouse, bringing the best companies together under one umbrella. As a result, group companies such as Odom, Blueview and Reson are now able to combine their talents and technology to provide their customers with a new level of collaborative technology, innovation and world-wide support.

A good example of this is the Teledyne Odom MB2 Multibeam echosounder, which incorporates a bottom detection algorithm developed by Teledyne Reson.

What makes the MB2 Special

- The MB2 is designed for quick mobilisation and faster surveys
- The MB2 features a user selectable frequency range from 200 to 460 kHz
- Selectable swath width up to 140 degrees
- Maximum sounding depth of 200m (Nadir)
- Real time Roll stabilization
- Supports dual head capability
- Option of in-built DGPS, Motion sensor and Surface sound velocity probe
- With integrated Motion sesor, there is a single cable for Sonar, SVP and Motion with all connections internal to the sonar head, resulting is reduced cabling, fixed offsets and faster setup time

- Sidescan, Snippets & Water column imaging part of standard supply , not as upgrades
- 24-bit signal processing reduces the requirement for the surveyor to constantly monitor and adjust real time gain
- Allows all gain to be applied digitally either in real time or post processing raw data. System is simpler to use and less prone to user error
- Field serviceable/upgradeable - Modular design allow trained engineers to swap boards themselves. Reduced down time for maintenance and costs for import/export



- Time stamping of data from all sensors to 0.1ms
- Collation of all data through one device – output through Ethernet
- Built in handle makes it easy to carry
- Universal Mounting Plate

Identifying a Layer's Lair – dotOcean Graviprobe

The dotOcean Graviprobe is a fast and light rheological and density profiling system. This free-fall impact instrument analyses the underwater sediment layers during intrusion. Under its own weight, it accelerates and penetrates fluid and consolidated mud layers. GraviProbe is able to distinguish the depth of the fluid and consolidated mud layers very accurately, even in gassy environments.

In the following section, we present a white paper comparing Echosounder and Graviprobe techniques in determining the fluid and consolidated mud layers.

Accurately determining fluid and consolidated mud layers, using Echo Sounder and GraviProbe.

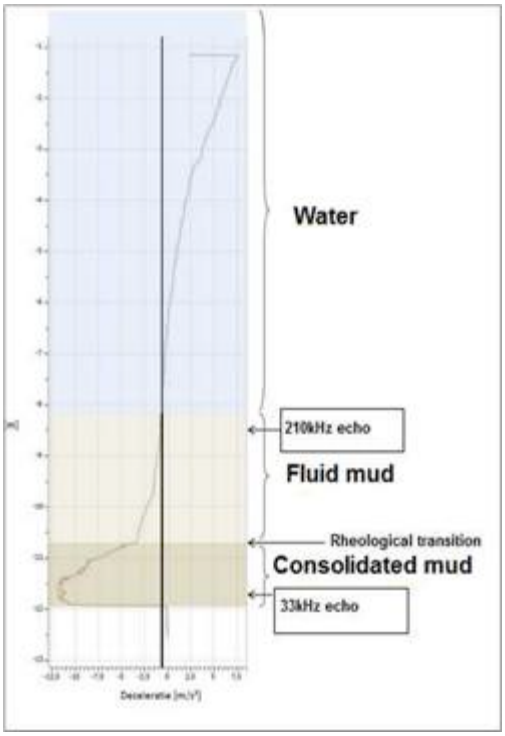
Fluid and unconsolidated sediment in waterways, channels and ports causes a challenge for the port hydrographic department to compose an exact image of the underwater bottom and is a common ground for discussion between the dredger and the port authority.

Echo Sounder

Echo Sounder systems are able to define the consolidated materials of the bottom. Using two diverse frequencies it is possible to indicate the presence of soft or unconsolidated material in the water column.

Identification of the top of the fluid mud is consistent with high frequency acoustics signal, 210 kHz Echo Sounder or multi beam (Figure). However, rheological transient between fluid and consolidated mud cannot be determined with acoustic measurement methods (33 kHz). (Figure)

Based on lower frequency images, certain assumptions as the depth and extent of the material may be assumed. This alone is however not adequate, the systems lack the resolution to provide accurate information about the different layers in the water column.



GraviProbe

The GraviProbe is a free fall impact instrument, analyzing the underwater sediment layers during intrusion. Under its own weight it accelerates and penetrates fluid and consolidated mud layers.

The data acquired from on-board accelerometers, inclinometers and pressure sensors is feeding a dynamical model which determines the geotechnical parameters of the intruded medium (depth, undrained shear and) The GraviProbe is able to very accurately distinguish the depth of the fluid mud and the consolidated mud layers.

Combining the GraviProbe and Echo Sounder data

The GraviProbe can show the exact reflection point of a high frequency or low frequency echo sounder and the rheological transition line between fluid and consolidated mud.

With the GraviProbe and Echo Sounder systems the hydrographic surveyor can compose a very accurate profile of the bottom and thus avoiding a conflict between dredging company and port authority.