



# Density is the issue

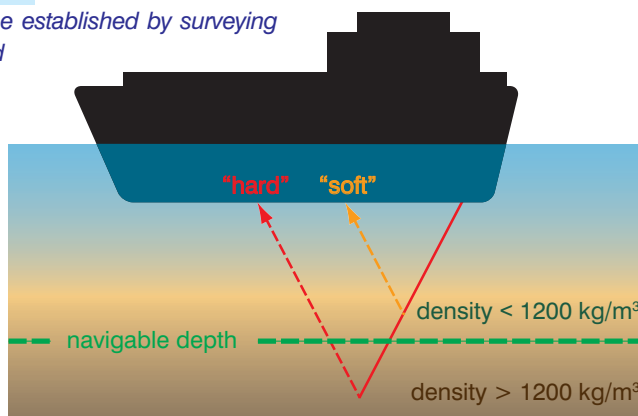
**T**raditional acoustic methods of seabed profiling cannot indicate the true navigable depth of a channel when there is a significant amount of fluid mud (see *Hydramotion Technical Briefing XL/4-3-01*).

Research has shown that deep-draught vessels can navigate safely through fluid mud up to a density of about  $1200 \text{ kg/m}^3$ . The challenge is to detect the depth at which the fluid mud reaches this critical density.

An echo sounder will often return two signals: a “hard” echo from the denser, well-consolidated mud of the seabed, and a “soft”

## Not quite rock bottom:

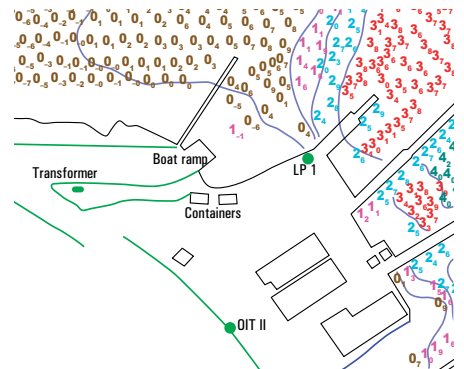
Nautical depth can only be established by surveying the density of the fluid mud



echo from the interface between the sea water and the top of the fluid mud. The safe navigable depth lies somewhere between these two, but can only be established by conducting a hydrographic survey of the density of the fluid mud.

## How is it done?

In the early 1970s the UK Atomic Energy Authority at Harwell developed a mud density gauge containing a radioactive



source and a detector. The degree to which the radiation is absorbed depends on the density of the material around the probe.

These nuclear (or “nucleonic”) density probes have a number of disadvantages. Since radioactive materials are involved they must be handled with care and their use raises environmental and marine safety concerns. They are usually very expensive and unwieldy, and require periodic recalibration. What is more, accuracy may be seriously affected by pollutants in the silt, including heavy metals, organic materials or dissolved gases.

## Tune in

An alternative is to use the “tuning fork” principle. Here the frequency of vibration of a fork-like sensor varies with the density of the surrounding medium. With the traditional design, however, granular material can get trapped between the tines (“legs”) of the fork, producing unacceptable errors in the readings.

The Hydramotion **MudBug** was developed to fulfil the clear need for an instrument capable of measuring the density of silt or fluid mud easily and reliably while avoiding the problems that have dogged earlier systems.

## Getting the measure of fluid mud

Using patented technology, the MudBug is a safe and convenient system for making reliable real-time measurements of silt or fluid mud density. It has the benefits of the tuning fork principle without the disadvantages of the conventional design. Only one tine of the fork is exposed, which eliminates the risk of material clogging the sensor while enabling the probe to deal with a wider range of mud density.

The instrument is powered through its USB connection to a PC or laptop on the surface. No separate power supply is required, making the MudBug the first device of its kind to be fully portable. Using the NaviTrend software supplied, density, depth and temperature measurements can be logged and exported to Microsoft® Excel® for further analysis. ➔

