



MARINE GEOPHYSICS

Ramboll performs a variety of different marine geophysical services. The outcome of the services ranges from bathymetry, seabed characterization and sub bottom investigation to localization of ordnance, and archaeological and biological mapping. The services are commonly used in connection with site investigations, environmental impact assessment (EIA), and for cable routing.

Introduction

Ramboll has specialised in providing a complete solution of high quality marine geophysical services. Our services comprise of data acquisition, processing and interpretation of multibeam echosounder, backscatter, side scan sonar, magnetometer, single- and multi-channel seismic. This is ensured by the teamwork of our in-house bio- and geoscientists and engineers.

Bathymetry

Multibeam echosounders are used to map the seabed topography (bathymetry). The result is a dataset connecting positions and water depths. An exact bathymetry is essential in almost all kinds of marine investigations, for example when planning submarine constructions or undertaking environmental impact assessments. See Figure 1.

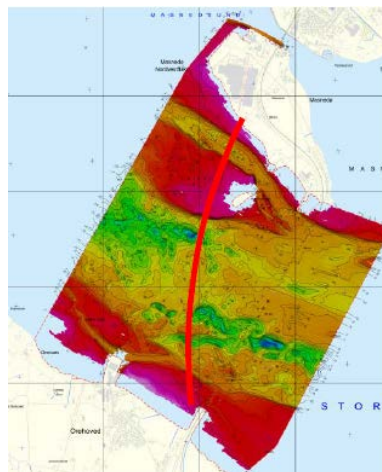


Figure 1: Depth to seabed.

Side Scan Sonar

Side scan sonar maps the texture of the seabed. It gives information on the biological environment and geological features such as sand ripples, boulders and rocks. Pipelines, cables, ship wrecks, and other man-made objects on the seabed can also be recognised. See figure 2.



Figure 2: Side scan sonar showing a 30 meter ship wreck.

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Selected marine geophysical references:

- Site investigation for a new tunnel in Copenhagen (Nordhavn, 2015). Service comprise of data acquisition, processing and interpretation of: multibeam echosounder, sidescan sonar, acoustic sub bottom profiling, geo-electrical measurements and refraction seismic.
- Site investigation for a new bridge (Storstrøm, 2014). Service comprise of data acquisition, processing and interpretation of: sidescan sonar, multibeam echosounder, Sub Bottom Profiler, magnetometer and multichannel seismic.
- Site investigation for a new windfarm (Kriegers flak & Horns rev 3, 2013). Service comprise of data processing and interpretation of: refraction seismic, multichannel seismic, multibeam echosounder, magnetometer and sidescan sonar

Based on side scan sonar data a seabed classification map can be made, that visualize the different sediments types and targets in a survey area. See figure 3.

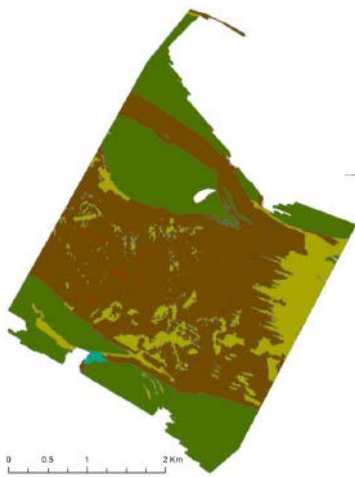


Figure 3: Seabed classification map.

Shallow Seismic

The subsurface geological settings can be mapped with a variety of reflection seismic methods called sub-bottom profilers (e.g. chirp, sparker). The profilers have different resolution and penetration into the seabed. See figure 4 and 5.

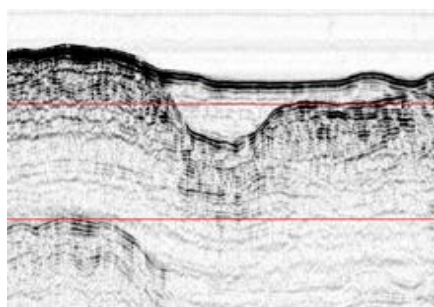


Figure 4: Single channel boomer data showing glacial clay overlaying sand (the distance between the red timelines is approximately 15 m).

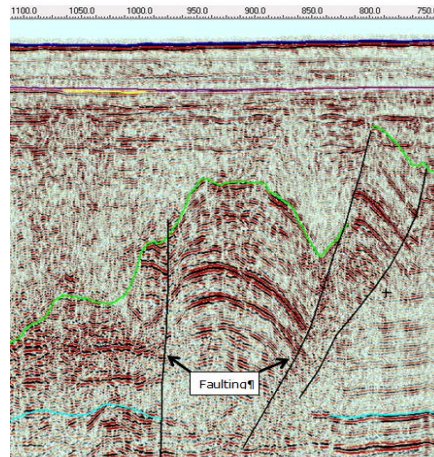


Figure 5: Multi channel sparker data showing faults. Depth app. 300m.

With refraction seismic a velocity profile of the subsurface can be obtained. As the velocity model varies with material stiffness and density, the method is therefore ideal for mapping the interface to bedrock. See figure 7.

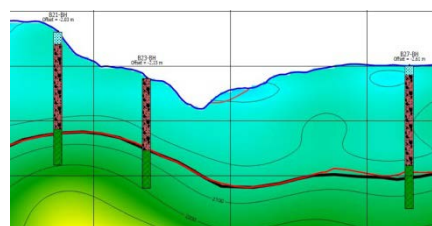


Figure 7: Velocity model with interpreted bedrock refractor.

Combining shallow seismic with data from other investigations (for instance from well logs) it is possible to form geological and geotechnical models for design.

Supplements

A marine geophysical survey can also include bottom samples, core samples, oceanographic measurements, biology samples, archaeological investigations, ordnance localization. Using a magnetometer it is possible to map magnetic objects. See figure 8.

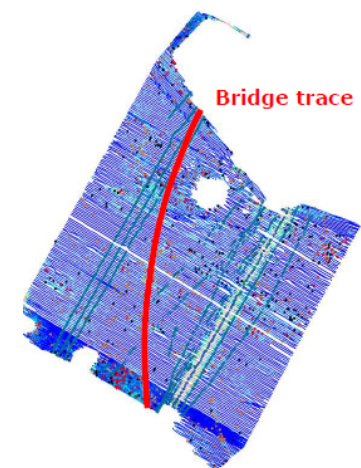


Figure 8: Magnetic object map.

Video can be used to image geology, archeology and biology as well as to inspect submarine construction. See figure 9.



Figure 9: Image of seabed video inspection.