CASE STUDY

DUAL-AXIS SCANNING SONAR FOR DREDGING APPLICATIONS

Precise mapping of a lake bed in real time

The Context

Dredging operations remove sediments and debris from the bottom of lakes, rivers, harbours, and other water bodies. In extracting recoverable residual sediments in a lake however, real time visualisation of the lake bed is important for the efficiency of the dredging operation.

For more than 25 years, echo sounders have additionally been used to determine the precise depth of the lake. By shifting the dredger during the dredging process, the distance between the echo sounder and the bottom is measured at specific points. A bathymetric map of the lake bed can be developed from these numerous point measurements.

The Challenges

Using conventional single-beam echo sounders, it is only possible to determine the depth of the water at a specific position. Local sediment movements following material extraction, such as material that slides, can only be determined when the dredger passes over the dredging area again. →

DAS HIGHLIGHTS

- Large coverage area
- Cost-effective rugged construction
- Rapid deployment and easy to use
- Provides digital records
- 3D profiling
- Cost-effective system

→ In addition, there is a potential for damage when scanning the lake bed with simple echo sounders. Landslides or creeping slope slides may only be detected when they occur on the surface of the water in the form of a break in the embankment, for example.

The Solution

Kongsberg Mesotech's Dual-Axis Scanning Sonar (DAS) allows a large area of the lake bed around the dredger to be mapped three-dimensionally within a very short time.

As a result, dredging losses can be reduced considerably, as residual thickness can be detected in real time. The operator can move the loosening tool to the appropriate location and dredge any remaining material with pinpoint accuracy, thus reducing avoidable dredging losses in the deposit.

In addition, there is less potential for damage when using the DAS. The DAS enables the rapid identification of over dredging or landslides caused by a too steep angle of slope. The operator can take prompt action and thus avert damage.

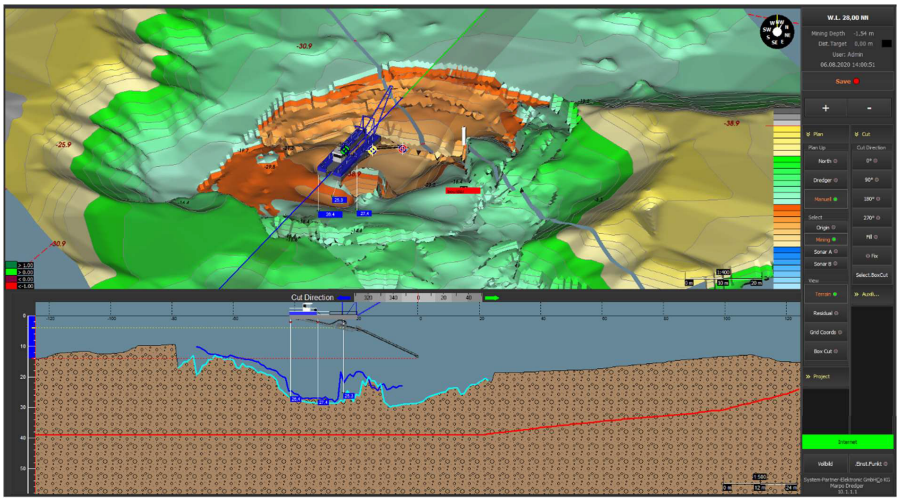
Also, the frequency of cost-intensive surveys to update the digital terrain model of the dredge monitoring system can be reduced. Due to the more accurate coverage of the DAS, the actual depth of the lake bed in the area of the dredging equipment can be directly recorded and processed into an up-to-date bathymetric map. Changes in the morphology of the lake floor can be detected even after the dredger has been moved to neighbouring areas.

The Result

SPE GmbH & Co KG (SPE) has now successfully integrated Kongsberg Mesotech's Dual-Axis Scanning Sonar (DAS) into their dredge monitoring system.

The DAS used by SPE consists of an echo-sounder transducer, which can be rotated within its housing by two rotation axes. The possible angular range is 360° around the vertical axis, and 90° around the horizontal axis. During the scan of the lake bed, the echo sounder is rotated along both axes in order to map the entire half-space under water in a multitude of individual measurements.

For each individual measurement, the distance to the lake bed is measured and recorded together with the respective angles of the axes, i.e. the direction of measurement. By combining the measurement results with the known position of the dredger, the exact position in three-dimensional space is determined for each measured value on the lake bed. By interpolating these points, it is possible to generate a planar representation of the lake bed for a considerably larger area around the dredger with considerably less time and more reliable data than was previously possible with conventional point echo sounders.



By using the Dual-Axis Scanning Sonar (DAS) from Kongsberg Mesotech, the position of the lake bed can be identified more precisely and, above all, dynamically, due to the two-dimensional recording. The dark blue contour in the profile corresponds to the measured depth values of conventional point echo sounders. The turquoise contour corresponds to the measured depth values of the DAS. The 3D view above shows the bottom of the water body recorded by the DAS.

The MARPO_DGPS system – short for Marine Position Differential Global Positioning System – is a dredge monitoring system developed by SPE for the efficient extraction of deposits and dredging areas. The development work on the use of a DAS in dredging and its implementation in the MARPO_DGPS dredge monitoring system was recently completed in an extensive test campaign. Partnering with dredge manufacturer ROHR-IDRECO, the tests took place during commercial dredging operations using suction and grab dredgers. At an average water depth of 15 m, depth values were collected in a radius of more than 40 m around the DAS sonar.

Summary

The DAS used by SPE enables a considerably more accurate and reliable recording of the lake bed during extraction than is possible with conventional point echo sounders. By continuously adapting the dredge planning to the survey results obtained by the DAS, avoidable dredging losses can be reduced, as well as the potential for damage. In addition, costs can be reduced by limiting the number of marine surveys to the minimum required by the dredging permit and no re-dredging is needed.

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