Object Detection in Port of Rotterdam

The Survey & Dredging Department of the Port of Rotterdam is responsible for maintaining agreed depths within the port area. Contracts between the commercial department and industrial clients establish access and berthing requirements. There is a regular monitoring survey programme based on siltation rates that guarantees continually updated information for dredging controllers.

The Department operates three multi-beam survey vessels. The Port of Rotterdam is an interesting area for hydrographic survey. Freshwater flow from the rivers Maas and Rhine mixes with saltwater tidal flow from the North Sea in the port area. Sediment flow from both river and tidal currents also meet in Rotterdam. The melting of alpine snow in spring or a north-westerly storm in November may mean us sending out dredgers for extra work. The environment also demands special hydrographic survey attention. Sound-velocity profiles that change over 20m/s in just 20m of water are normal. Silt in suspension mixed in the water column does not contribute to a clear multi-beam picture. To handle this situation, a sound-velocity profile is taken at least hourly and survey areas subdivided into small sections. Online surveyors are very active controlling multi-beam settings during operation. Transmission, gain and pulse-length settings are crucial for accurate bottom registration. The type of multi-beam echo sounder used must allow these activities to be carried out in a user-friendly way, even from a small, moving vessel!

During monitoring survey it may happen that irregular bottom echoes appear in multi-beam records. Especially near city quays, the question facing the surveyor is whether an object or an acoustic disturbance is being encountered. To answer this with data records we have introduced multi-beam data-cleaning software Ã¢â‚¬ËœQloudÃ¢â‚¬â„¢ from QPS BV. This tool enables the visualisation and cleaning of large multi-beam datasets in their original format. Viewer data redundancy can be easily detected by track overlap.

If any strange bottom pattern is detected in either online multi-beam information or later during data cleaning onboard the survey vessel, a Ã¢â‚¬Ëœpossible objectÃ¢â‚¬â„¢ may be discerned by examining overlapping tracks. If there are no overlaps, a new track is surveyed and added to the Ã¢â‚¬ËœQloud jobÃ¢â‚¬â„¢. Apart from a high-resolution, 3D-view bottom image, Ã¢â‚¬Ëœslice-viewÃ¢â‚¬â„¢ information tells more about the shape and redundancy of any possible object. This view gives all available multi-beam information, using a unique colour allotted to each sailed track. Using Qloud, all views are linked to each other. Changing data in the slice-view will also change the other views Ã¢â‚¬Ëœon the flyÃ¢â‚¬â„¢ within a second. Data is never deleted, but only flagged out.

Shallow water conditions in the port (up to 25m) and the busy shipping traffic make side-scan sonar survey ineffective for maintenance surveys. Using state-of-the- art multi-beam echo sounders, Qloud visuals of bottom objects are clear enough to detect.

Before even considering using multi-beam echo sounder for object detection, the survey system must be fully calibrated. If the data is not consistent, overlap data will never give a clear picture. The calibration process includes all survey sensors, such as the sound-velocity probe, motion sensor, gyro compass, RTK positioning and the multi-beam-transducer mounting angles. Port of Rotterdam survey vessels are calibrated or checked every two months using a steep slope and a lock floor.

The visibility of an object also depends on water depth, type of multi-beam echo sounder and, of course, the size of the object. Of these, only the type of multi-beam echo sounder can be changed! Important multi-beam system parameters for object detection are small beam width, high update rate, numerous beams per swath-degree, and no internal thresholds or filters.

In our dredging control function we mainly concentrate on effective production: removing silt as quickly and cheaply as possible. This will not contribute to time-consuming object-inspection surveys. But possible objects lost in Rotterdam Port may include cars, anchors or anchor chains, shipÃ¢â‚¬â„¢s propellers or lost containers and these may cause serious damage to dredging equipment or ships passing at minimal UKCs. So we have to combine effective dredging survey and object detection.

Since 1997 we have been using Reson Seabat multi-beam echo sounders for this job. We have now introduced Qloud software onboard survey vessels, in combination with Reson 8125 narrow-beam multi-beam echo sounder, so that high-speed bathymetric surveys for dredging operations can be carried without missing any possible objects. Two surveyors are onboard each survey-vessel to effectively handle the enormous datasets involved. The online surveyor will operate the online systems and continuously monitor the multi-beam system display for possible objects. The offline surveyor loads all raw data into Qloud to clean, validate and check all depth data. The offline surveyor can be easily informed by the online surveyor, or by simply looking out of the window, about disturbance from passing ships or underwater port constructions.

Only a gridded dataset of 1x1m resolution is sent from survey vessel by email to the charting and dredging departments. Possible objects discovered during a survey will lead to this data being sent separately to the office at the highest possible resolution. A diver or ROV inspection will now identify the object. The hydrographic surveyors will also give their opinion on the possible object; they will not have too much difficulty in detecting a car-wreckÃ¢â‚¬Â¦ there may even be a little bet on the makeÃ¢â‚¬Â¦

Maasvlakte-2
Object-detection survey was carried out for the planned land-reclamation project Ã¢â‚¬ËœMaasvlakte-2Ã¢â‚¬â„¢. In this case, object

detection was the main goal. To cover a large area in a short time, the North Sea Directorate of Dutch national water authority Rijkswaterstaat conducted a side-scan survey. The survey generated an object list of 39 suspicious contacts. Port of Rotterdam in co-operation with Wessex Archaeology surveyed these objects using the high-resolution Reson Seabat 8125 system and Qloud validation tool.