Underwater Archaeological Object Detection

Increasing interest in maritime archaeology has led to a growing need for measuring techniques or innovative methods for detecting and identifying underwater objects. This article presents some results of the first commercial maritime archaeological investigations in the Netherlands.

Detection and identification of objects is of major importance in the marine construction industry. Objects on or below the seafloor may form obstacles to dredging and can cause serious and costly delays in any construction operation. Such obstacles have therefore to be mapped and removed before the start of operations. Apart from Ã¢â‚¬Ëœcommonâ€â„¢ dredging obstacles like recent shipwrecks and debris and ammunition from the Second World War, another type of obstacle has been receiving increasing attention over recent years: archaeological artefacts lying on and directly below the seabed.

IMAGO Project

According to new legislation derived from the Treaty of Valletta (see text box), archaeological artefacts should be protected and conserved, if possible in situ, this being the responsibility of the disturber of the seabed. The marine construction industry now faces a problem. On the one hand obstacles need to be removed before operations begin; on the other, if such obstacles are of archaeological value they are not to be disturbed and need to be protected. This raises the question of how to distinguish between archaeological and non-archaeological objects. The more general and major question remains of how efficiently to detect and identify objects under water.

In order to answer these questions the Ministry of Transport, Public Works and Water Management (Rijkswaterstaat) in the Netherlands carried out a dedicated project between 2001 and 2003. Called IMAGO, a Dutch acronym for Innovative Measurements of Sunken Objects, the objective of this project was to develop an efficient measuring technique or innovative methods to detect and identify wooden objects of larger than 1m in diameter, up to four metres below the seabed. Wooden objects are difficult to detect in a marine environment and therefore posed the biggest challenge in terms of optimising existing techniques and methods. Several specialists companies and organisations were invited to take up this challenge and test their proposed techniques in both a laboratory environment and in the field.

The project led to the following conclusions. No single overall geophysical technique exists for detecting and identifying all types of underwater objects; rather, a combination of several techniques is required. Bottom-penetrating techniques are in general expensive in terms of acquisition and processing. Interpretation and identification is difficult, raising more questions than answers; these techniques are thus less suitable for quick area scans. An extensive desk-study, including the acquisition of historical and geological information of the investigated area, is a cost-effective approach, reducing expensive and time-consuming fieldwork.

Barrage Assessment

The conclusions of the IMAGO project were put into practice in the first commercial underwater archaeological assessment performed in the Netherlands: the project Ã¢â‚¬Ëœbarrages Grave en SambeekÃ¢â‚¬â„¢ carried out in 2005.

To improve flood protection, parts of the river Meuse in the south of the Netherlands are over coming years to be deepened by up to three metres below the present riverbed. The plans for the Meuse are being drawn up and implemented by Project Organisation Ã¢â‚¬ËœDe MaaswerkenÃ¢â‚¬â„¢, in a co-operation between Rijkswaterstaat, the Province of Limburg and the Dutch Ministry of Agriculture, Nature Management and Fisheries. High levels of expectation concerning the presence of obstacles to dredging and/or archaeological artefacts led to an extensive investigation following the conclusions and recommendations of the IMAGO project. Step 1 involved desk-study (by Alterra) describing the history and geology of the research area and resulting in a number of archaeological expectancy maps. Step 2 involved combined side-scan sonar and multi-beam survey, carried out by archaeological consultancy ADC Archeoprojecten in combination with Rijkswaterstaat. Multi-beam data of highest possible resolution was acquired only at locations of interest derived from the side-scan sonar survey, thus saving sailing and processing time. Step 3 involved dive inspections to identify the remaining locations of interest derived from the side-scan sonar and multi-beam survey; dive inspections were carried out by the diving contractor ADT/Subcom, supervised by ADC Archeoprojecten.

Survey Results

A total of 222 features over a distance of 24.3 kilometres of river were marked by side-scan sonar and mapped by multi-beam. Despite the relatively low resolution of the multi-beam system (Reson Seabat 8101, 100 beams), maximum resolution was obtained using the highest ping rate in relatively shallow water. After processing and interpretation, 58 locations were marked as being of possible archaeological value and selected for detailed visual inspection. A dedicated vessel with good positioning facilities was mobilised for the diving inspection. Visual inspection of all 58 sites was completed within six days and four locations were positively identified as important archaeological findings.

At Barrage Grave the remains of two historical shipwrecks were discovered; samples were retrieved and dated 1596 AD Ã‚Â± eight years (see Figure 3) and 1262 AD Ã‚Â± five years. The artefacts consisted of an oak board and several oaken timbers. At Barrage Sambeek two identical ferryboats were found, in perfect condition and dated early twentieth-century (see Figure 4). These were lying in the vicinity of a recent car-wreck. In addition, six recent shipwrecks, four car-wrecks, one shipÃ¢â‚¬â„¢s anchor (see Figure 5), eleven trees and various

piles of debris were identified and marked as obstacles to dredging.

New Discoveries
At the beginning of this year, experience gained on several projects resulted in the setting up of a new company, Periplus Archeomare BV. By compiling different geophysical and hydrographic datasets and putting them into an archaeological perspective the above-described approach to the investigation of marine construction areas has proven very successful. Unknown and previously undetected wooden shipwrecks have been discovered during two projects: the Norned project involving an electricity cable running from Norway to Groningen in the Netherlands, and the Vespa project, a new sluice complex at the Afsluitdijk in theNetherlands. The archaeological significance of these artefacts has still to be established.

Concluding Remarks
Marine contractors should be well aware of the regulations enforced by the new legislation regarding archaeological heritage and should implement the various stages of research at an early stage in a project, where bottom disturbance is part of construction activities. The practical approach derived from the IMAGO project has proven to be very efficient. Archaeological assessment of an area is based on similar geophysical and hydrographic data as that collected from an engineering point of view. Using the described approach will protect archaeological heritage without frustrating the execution of a construction project.

Treaty of Valletta
In 1992 the European Commission signed a treaty concerning archaeological heritage the major points of which are:

- To protect the archaeological heritage as a source of the European collective memory and as an instrument for historical and scientific study, whether situated on land or under water.
- To make provision for the conservation and maintenance of the archaeological heritage, preferably in situ, or provide appropriate storage places for archaeological remains that have been removed from their original location.
- To make provision for the financing of archaeological research and conservation within the budget of projects in the same way as for the impact studies necessitated by environmental and regional planning precautions.
- To promote public awareness

The treaty was signed in Valletta, Malta in 1992 and passed into national law in 2001 (UK) and 2006 (Netherlands).

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