## *PART 2: CURRENT AND POTENTIAL APPLICATIONS OF AIS*

# Near-shore Automatic Identification Systems


Last month we gave an introduction to automatic identification systems, developed to allow ships and coastal stations to accurately locate and identify each other. Here we describe the current and potential applications of the technology as applied to marine civil engineering, ranging from the use in a wave energy project and oil spill applications to the use in ports and harbours.

Of particular interest is the provision of binary messages such as the type 8 TideMet message with an embedded weather and tidal data payload (see Figure 1). The real-time tide and meteorological data are of direct use in a wide variety of marine civil engineering applications and can be used in the design, planning, construction and operational phases of many marine projects.

**Energy Platforms**

The operational use of automatic identification systems (AIS) has become mandatory for contractors involved in the construction and service of energy projects such as offshore wind farms or wave energy platforms. The primary concern is safety, so that all current positions of work vessels can be seen by each other and also by site management. The use of up-to-date navigation charts and AIS positioning helps prevent the accidental fouling of underwater cables with mooring or positioning anchors. During the construction of energy platforms, the normally accepted contractual limit of safe working conditions is a stated maximum significant wave height. This parameter is transmitted by an AIS TideMet station fitted with a radar tide sensor, forming a common reference for all to enable the decision for safe working to be mutually agreed.

**Wavestar**

Ohmex is a founder member of the EU Wavestar wave energy project, with responsibility for the provision of maritime safety, weather and tide instrumentation (see Figure 2). In the successful prototype currently running at Nissum Bredning in Denmark, the weather information is used to predict the wave climate so that the paddle performance can be optimised and the paddles raised out of the water prior to a storm or other high-energy event that may damage the platform. These structures are constructed in shallow water and become prime sites for fish habitats, and so naturally attract fishing vessels. For the larger prototype being constructed at Hanstholm (Denmark), the AIS will therefore also be required to transmit a safety zone area and warning message to prevent collisions during poor weather conditions. The AIS TideMet device can also be connected to a GPS base station and transmit GPS differential corrections directly to local AIS position receivers using binary message type 17. These local GPS corrections enable vessels to safely navigate around structures and locate floating terminals or moorings, particularly in areas outside the envelope of coastal marine beacons or satellite-based augmentation systems (SBAS).

**Dispersion Models**

Live AIS TideMet information is potentially of great use in real-time dispersion model calibration and calculations, helping the simulations by providing the actual values of the main prediction variables of tide, current and wind conditions. In the case of sewage discharge, the live data would help determine the optimum position in the tidal cycle for effluent discharge, with the facility to also check current wind conditions. In addition to TideMet data, the AIS aid to navigation (AtoN) is also able to relay type 9 search and rescue messages transmitted by helicopters and life-saving vessels in the event of a marine accident or man overboard incident. AIS data could also help

create a dispersion model scenario of an oil spill or other contaminant discharge incident where a mathematical model is used to calculate the likely spread and resources required to contain the pollution (see Figure 3).

**Ports & Harbours**
The most significant users of AIS TideMet information are port and harbour authorities concerned with the general safe navigation of vessels, the safety of persons in transit and the prevention of environmental pollution. Use of this information is also increasingly spreading to workboats and craft involved in general marine construction activities and dredging. Surveyors and dredger operators have moved away from using tide gauges in favour of precision GPS elevations as their preferred vertical datum, though this is not a practical solution as far as the reliability and all-weather requirements of a navigational user are concerned. Most marine users currently need to request local tide and weather values over speech channels from the port control or read some form of visible tide value such as a tide board; they certainly do not have access to a survey-quality receiver for deriving tidal heights from precision GPS. Although major dredging contractors make extensive use of precision GPS for accurate elevation control during major excavation activities, many minor dredging operations rely on tide gauge information to control the vertical elevation of their excavators. The TideMet elevation information is readily available on the AIS receivers used by most dredging excavators and hopper barges and can easily be incorporated as real-time input to most machine control systems.

**London Olympics**
The prime UK installation of the AIS TideMet system is at Three Mills Lock (formerly Prescott Lock, see Figure 4), the gateway to the new London 2012 Olympic site, destined to be the greenest Olympic Games in modern history. The body in charge of construction and design has said it champions low waste and low carbon emissions and promotes green forms of transportation. With this in mind, British Waterways has undertaken the most sustainable waterway restoration possible with the refurbishment and modernisation of the Bow Back Rivers, a network of post-industrial waterways that has been derelict and underused since 1945. Green benefits of the scheme will include 24-hour navigation with access for large 350-tonne barges. Early estimates indicate that around a third of the heavy traffic for the Games could go by water during the construction phase alone. The rivers could carry up to 8,000 tonnes of construction materials a day, removing up to 1,200 lorry journeys from congested local roads each week and saving about 4,000 tonnes of $CO_2$ emissions during the construction period alone. During the Games and the immediate legacy period, waste and recyclates, with an estimated volume in excess of 1.75 million tonnes, could be transported by water to the processing site at Rainham in Essex, saving a further 175,000 lorry journeys.

**Latest Technology**
To facilitate the larger volume of both commercial and leisure vessel traffic, a modern control centre has been incorporated in the new lock structure at Three Mills. The centre includes the installation of an AIS TideMet system that will make extensive use of the latest tracking technology to both aid the flow of traffic and maintain a high level of safety within the inland waterway system. Early trials of the system showed tide broadcasts being seen as far away as Gravesend to the east and Waterloo Bridge to the west of the site. Particular attention will be paid to the safe mixing of leisure vessels and working barges, to avoid the occurrence of any disaster similar to the collision between the Marchioness riverboat and Bowbelle dredger in the River Thames in 1998, which resulted in 51 deaths. Under International Maritime Organization regulations, all tug and leisure vessels will be obliged to carry AIS transponders to show their position to all other AIS users within the immediate range of the network and also in the navigable approaches from the Thames.

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**Further Reading**
Read, E.F., Heaps, W.S., 2008. Tidal & Meteorological data over AIS. Hydrographic Society. Hydro8 proceedings.