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CHARTING THE TIDAL THAMES

CHRIS HOLCROFT explains how GIS lends a helping hand

If you were responsible for piloting a 200,000 tonne cargo ship safely through the Thames Estuary, knowing that, in places, a mere 900mm lies between the keel and the river bed, you would want to be pretty sure that your navigation charts were accurate and up to date.

That's precisely what the 90 or so Port of London Authority pilots have to cope with every day. And they rely on charts produced by the Port of London Authority's Hydrographic Service with the aid of the latest digital mapping and GIS (geographic information system) software.

Commercial port

While everyone is familiar with the River Thames as a tourist attraction, few are aware of its present-day role as a busy commercial port.

In fact, the Port of London is the largest port in the UK, with more than 28,000 vessel movements per year from 70 riverside wharves and cargo terminals. In sum, these handle around 53 million tonnes of cargo each year, including 19 million tonnes of oil and oil products.

In addition to this massive cargo business, there is a growing tourist industry requirement for cruise liners able to navigate the Thames into Central London. To this end, the Tower moorings in the Pool of London can take vessels up to 160 metres in length, while the proposed Greenwich Maritime (Cruise) Terminal will to take vessels of up to 240 metres in length.

Responsibility

The Port of London comprises the entire tidal Thames, from Teddington in west London, eastwards to an imaginary line across the Thames estuary between Margate and Clacton-on-Sea.

Responsibility for pilotage, navigation and conservancy over this 140 km stretch falls to the Port of London Authority (PLA). It is also responsible for licensing watermen and lightermen, for river structures and moorings, and for oil pollution matters.

To ensure that the Port of London maintains its premier position, the PLA invests heavily in facilities and services for all who use the tidal reaches of the Thames. Key to these services and fundamental to navigational safety is the ongoing surveying and charting of the river bed. This is the responsibility of the PLA's Hydrographic Service which, together with the PLA's head office and Port Control Centre, is based alongside the Thames at Gravesend in Kent.

Tower Bridge, gateway to the Pool of London.

From here, the Hydrographic Service operates four survey craft. The 26m conventional steel monohull Chartwell and the 14m GRP construction, twin water-jet catamaran Yantlet cover the Thames Estuary and river, while two launches of 8m and 5.5m length are work close in-shore and in associated waterways.

DGPS adopted

Depths are taken using sonar equipment and the resulting data stored onboard on PCs or laptops. For positioning purposes, the PLA has recently adopted DGPS as its principal positioning system for use from the City of London to the Outer Thames Estuary. For positioning within the Central London area, DGPS is used wherever possible, satellite and differential coverage permitting, but failing this, a tripod- mounted Geodometer 140T range/bearing system is employed.

The survey data are merged with Ordnance Survey Land Line maps and other data relating to real-world objects, such as piers,

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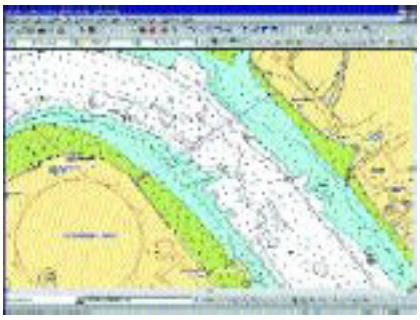
jetties, moorings, buoys etc. and non real-world objects such as navigation channel edges. The resulting charts are disseminated to PLA pilots, harbour masters and others. While this constitutes the main work of the Hydrographic Service, it also undertakes surveys and provides, for example, information on erosion and shoaling of mud flats and banks as part of the PLA's conservancy work.

Until fairly recently, these charts and maps were produced manually by tracing OS Land Line map features onto acetate overlays and then adding the survey data. With over 40 large scale charts plus 70 or more at 1:25,000 scale needed to cover its area of jurisdiction, the PLA faced a costly and time-consuming task in keeping them up to date.



Getting automated

Five years ago, and following a feasibility study, the decision was taken to acquire a computer-based system for chart production. The software chosen by the Hydrographic Service was Cadcorp SIS (Spatial Information System) from UK-based digital mapping and GIS software developer, Cadcorp.

John Pinder, the PLA's assistant hydrographic officer and the man responsible for developing and supporting the system, outlines the rationale behind this decision. "Having looked at the different mapping and GIS software products available, we chose Cadcorp SIS because it was the one product that enabled us easily to zoom into an area of map, place a grid and title block, and print it at the required scale. That seems a simple enough task but at the time there were very few products that could do it easily. And there still aren't. Furthermore, a standard facility in Cadcorp SIS is its ability to read and display Ordnance Survey NTF data, as well as a very wide range of other formats in native form. Other products require the purchase of a translator."

Maintenance of base maps is aided with the receipt, every three months, of a batch of updated tiles from Ordnance Survey. All that is required is to copy these into Cadcorp SIS in their native OS format and overwrite the old files. There is no need to go through a conversion process. All appropriate tiles are immediately updated and the vast majority of the 200 or more revised charts and maps produced annually by the Service are now generated with the help of Cadcorp SIS.

Data handling

Data, be they geographic or non-geographic in nature, are imported into the system as native contour data, DXF, TIFF or ASCII files. In addition, and because a great deal of essential but non-OS data exist on the original acetate overlays, these are scanned as required and imported as georeferenced raster files.

All data are assigned to one of the five layers that constitute a PLA chart, i.e., Topography (OS Land Line data) * Channel edges/anchorage areas, etc * Moorings, wrecks and buoys (imported from existing PLA databases via Cadcorp SIS ODBC) * Contours * Depths.

Layers can be viewed individually and combined with a template to add grid, north point, title block etc. to printed output. Specialised navigational symbols and line-styles were developed internally by the Hydrographic Service using Cadcorp SIS programming facilities.

Charts for use by PLA pilots are output by ink jet plotter 30 or 40 at a time. In addition, those same data are sent to the UK Hydrographic Office in Taunton for publication in British Admiralty charts. The frequency of chart updating depends to a large extent on the characteristics of each part of the river but, typically, each river segment is surveyed every four months, with the entire river being re-surveyed and recharted every eight to ten years.

Looking ahead

With all chart revision and production work now largely automated, John Pinder and his team plan to utilise the system in other areas.

One relates to combating pollution caused by oil and other hazardous materials and relates to legislation enacted following the Milford Haven disaster. The PLA's Hydrographic Service is currently using Cadcorp SIS to build a database for this purpose.

Data from English Nature on areas of environmental sensitivity and vulnerability, as well as Sites of Special Scientific Interest (SSSIs), are being collated and merged with the Hydrographic Service's own data to create a unified database for pollution planning and control.

When completed, this will not only enable the PLA to readily update the information as the situation on the river changes, but also to use the spatial query and analysis facilities of Cadcorp SIS to generate specific pollution-related information, as and when required.

Another potential use for the system is to make Hydrographic Service data available to the PLA's Vessel Traffic Management system. This would make information on, say, the depth of water in a particular berth, accessible with a single mouse click.

In the short-term, however, the plan is to move to the production of electronic navigation charts (ENCs), again using the Cadcorp SIS database. These digital replacements for paper charts will be transmitted over radio links to vessels. The move will require integration of the Cadcorp SIS database with a specialised ENC production system.

Overall, the PLA's Hydrographic Service has achieved a good return on its investment so far and is confident of even greater benefits to come.

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