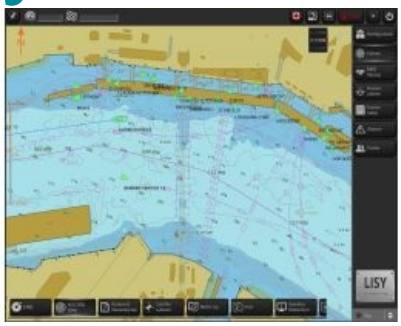
FROM PING TO CHART

Centralised Data for Hamburg Port Authority



The Port of Hamburg is the third-largest container port in Europe and among the biggest in the world. There are almost 300 berths with a total of 43 kilometres of quay servicing around 9,000 ships per year. The Hamburg Port Authority (HPA) is responsible for the management of the harbour and has its own hydrographic survey department. This department collects its own multibeam and laser data which is augmented with additional data collected by the land survey department of the HPA and with data from external organisations. All bathymetric data is stored in a central Bathymetric Database (BDB) and from there disseminated in various forms to various users.

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The HPA operates four vessels, the *Deepenschriewer* (English: Depthlogger) 1 to 4. They are equipped with multibeam echosounders and positioned using a Trimble VRS RTK network. Depending on the area and the rate of siltation surveys are performed from every two weeks to every four years. Though different multibeam systems are in use, all the data is collected similarly using QINSy for data acquisition. For further processing and validation, the multibeam data is exported to XTF files which are then processed in Teledyne CARIS software as part of the HydroCAD 2 software suite. Part of the bathymetric surveys is the determination of the dredging depth (based on a 1.2 kg/l density layer). These surveys are additionally performed using a singlebeam echo sounder and a Rheotune system connected to the SILAS software to determine the dredging depth. The line data from the singlebeam is interpolated using triangulation and stored together with the multibeam data.

The vessels also have the option to collect laser scan data using a Riegl scanner and associated software. This data is however not considered part of the bathymetric dataset and not stored together with the bathymetric data. The topographic data for the nautical charts comes from the land survey department of the HPA where both traditional land surveys as well as photogrammetry are performed. This data is processed in ArcGIS and from there made available together with the bathymetric data.

Some data comes from surveys performed by the Bundesamt für Seeschifffahrt und Hydrographie (BSH – Federal Institute for Sea shipping and Hydrography) for the dump sites near the river mouth and the Wasserstrassen und Schifffahrts Verwaltung (WSV – Federal Authority for waterways and shipping) for the (dredged) river depths. For some areas that have to be monitored, surveys are contracted out as well.

Storing the Data

The HPA has a long history of centralizing bathymetric data. Before 2003 a tailor-made software suite was used called HydroCAD. HydroCAD was based on CARIS products but highly customized by Atlas Elektronik. In 2003 it was decided to move from tailor-made software to Commercial Off-The-Shelve (COTS) software, switching to a standardized CARIS suite called HydroCAD 2. The software migration was finished in 2007 and since the several PortWISE projects have been run to improve the functionality. Due to the selection of COTS software, rather than tailor-made software new functions may take some time to get included in the standard products.

The central product in HydroCAD 2 is the Bathymetric Database (BDB). The BDB serves as a central storage for all the bathymetric data obtained from HPA's own vessels but also for storing the bathymetry from external sources. The topographic data associated with the nautical products (such as harbour contours) are stored in the HPD to allow the production of nautical charts which have to contain both contours, aids to navigation as well as bathymetry.

Electronic Navigation Charts

One of the main products that the HPA generates directly from HydroCAD 2 are bathymetric Electronic Navigation Charts (bENC) and regular ENC's. These are generated directly from the BDB. The difference between a bENC and a regular ENC is that the bENC contains very detailed bathymetric data but no items such as aids to navigation. The ENC is an official navigation product including topography and aids to navigation but with a limited amount of depth information (mainly contours and spot depths of the maintained depths).

The main customer for the bENC is the HPA itself with the product being used by the pilots, the nautical centre and on-board the harbour patrol and survey vessels. The ENC data is supplied to the German Hydrographic Office of the BSH where the data is integrated with other sources to provide a formal and complete ENC. This is officially published by the BSH and based on data from the HPA where the Port of Hamburg is concerned.

Other products from the BDB

Besides the ENC's there are a few other products for (internal) customers which are also based on the data in the BDB. As the Port of Hamburg requires continuous dredging, one of the important users is the dredging department. They are provided with 'digital' paper charts in pdf format containing the latest multibeam and density information. Various charts are made, one showing the 1.2 kg/l dredging depth vs the nautical depth from the multibeam. These charts are used to decide which areas require dredging. The volume to be dredged is then computed by the dredging department in the BDB. Information is also supplied to the dredging companies. The nautical centre and asset management are also supplied with digital paper charts and digital paper profiles produced in the same way. The nautical centre uses the information for port planning whereas asset management mainly uses profiles to assess the state and required maintenance of the river banks.

An important user is the hydrology department where model computations on water levels, sedimentation and river discharges are performed. Part of their services is the prediction of storm surges so that the local population can be warned in case of (extremely) high water. The hydrologists use SeDiRa from Smile Consult which requires gridded bathymetric information. This information is supplied from the BDB as a series of standardized OGC geographical services generated by the CARIS Spatial Fusion Enterprise Server (SFE). Information metadata is made discoverable using a Catalogue Service for the Web (CSW). After selecting a dataset, it is transferred using a Web Coverage Service (WCS). For other users, the data is also serviced through the HPA geoportal as an interactive map using a Web Map Service (WMS).

Workflow Automation

As shown, many of the products are standardized and generated from the same data sources for the same groups of customers. Thus, much attention has been given recently to the automation of the production processes. A major step has been the automation of the bENC and digital paper chart production in the PortWISE 2a project. For this, several Python scripts, have been created. The scripts are owned by the HPA and were initially created by Teledyne CARIS. They can be modified by the HPA using a Python interface. In general, small changes are made in-house whereas the larger changes are done by Teledyne CARIS because they have access to more specialized software developers.

A next step in the automation process is the replacement of the digital paper chart with a more interactive version in the nautical centre (and possibly later the dredging department). For this an interactive chart table from Workplace Solutions (WPS) in Hamburg is used called the Smart Sounding Table. Using digital ship models the personnel of the nautical centre can make simulations on the table using the latest bathymetry as the table is directly connected to the information from the BDB.

Conclusion

The Hamburg Port Authority has a long history of centralizing their data. With the CARIS based HydroCAD 2 suite, they are using a standardized product to aggregate and supply data and ENC's to various users around the port. Thanks to automation many of the regular production processes can now be sped up whilst the users are provided with more advanced techniques to use the data.

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