Final Report of the "Intelligent Marine Fairway" Project to the 9th ARHC meeting

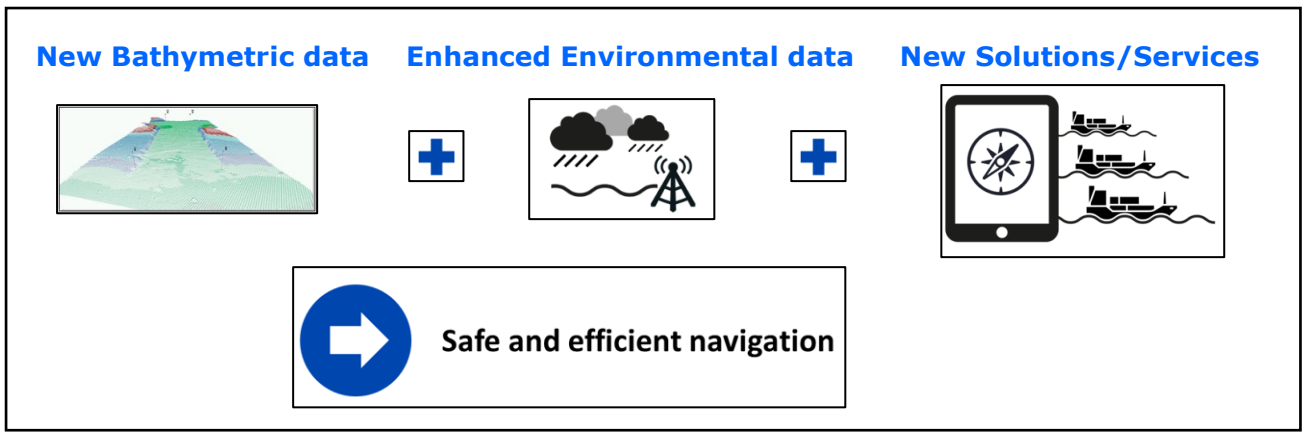
by Finnish Hydrographic Office

1 General info of the Project

The Digitalization and Automation is one of the main objectives in the government strategy in Finland. The strategy directs public agencies e.g. Finnish Transport and Communications Agency Traficom to digitize theirs datasets and services and encourage the development of automation on land and at the sea.

The Finnish HO has received requests e.g. from pilots for more detailed bathymetric data along fairways. The seabed topography is particularly important on those fairways where vessels and especially bulk carriers are currently unable to utilize their full cargo capacity that is where under keel clearance (UKC) is critical. A dredging has traditionally been a solution for greater drafts for the vessels visiting Finnish ports. Due to the seabed characteristics and increasing costs of dredging operations on Finnish coastal waters, other means are required in order to gain a more efficient waterborne transport.

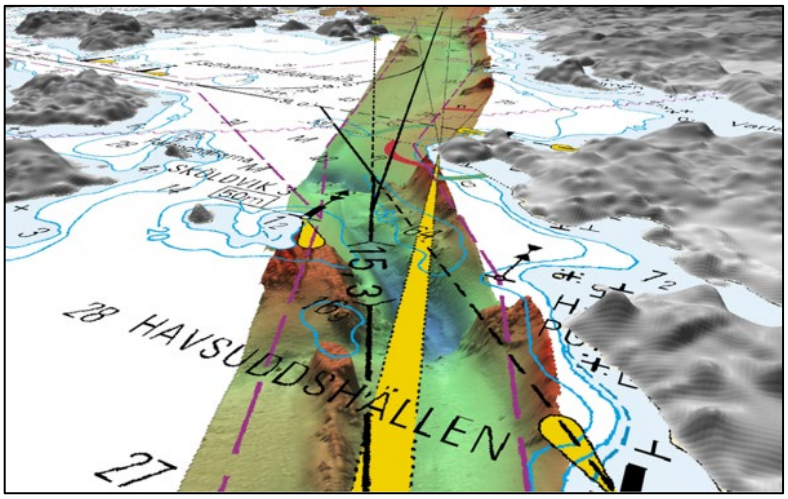
The Project started in 2015 and the final report published at the end of 2018. In the first phase of the project, studies focused on data sources that influence transport efficiency and safety of navigation. During the project, some outcomes of these studies results inputs to the development of IHO S-102 standardization work. The second phase of the project covered studies of data visualization and interoperability in the bridge simulator and the navigation software environments.



2 Focus of the studies

2.1 Bathymetric Surfaces (BathyS)

The Finnish HO procured a hydrographic survey campaign on three fairways leading to ports in order to get high quality and up to date bathymetric data for the project. The project created, tested and analyzed the BathyS (pilot) products using source data from areas that reflect conditions on fairways in Finnish coastal waters.



The most important areas of the studies related to the Bathymetric Surface products were:

- Requirements / characteristics: grid size, gridding (selection) method
- Quality / reliability: source data criteria, reliability of grid data
- Specifications / portfolio: coverage, scale bands
- Production: tools and process

FHO experts working with the Bathymetric Surfaces took part of the IHO S-102 PT work providing comments based on outcomes of the tests and analysis made in the project.

2.2 Bridge simulator tests

The project tested the BathyS products with a bridge simulator to optimise grid size and evaluate feasibility. The simulator proved to be useful when presenting new navigational data and use cases to stakeholders and especially to the pilots.

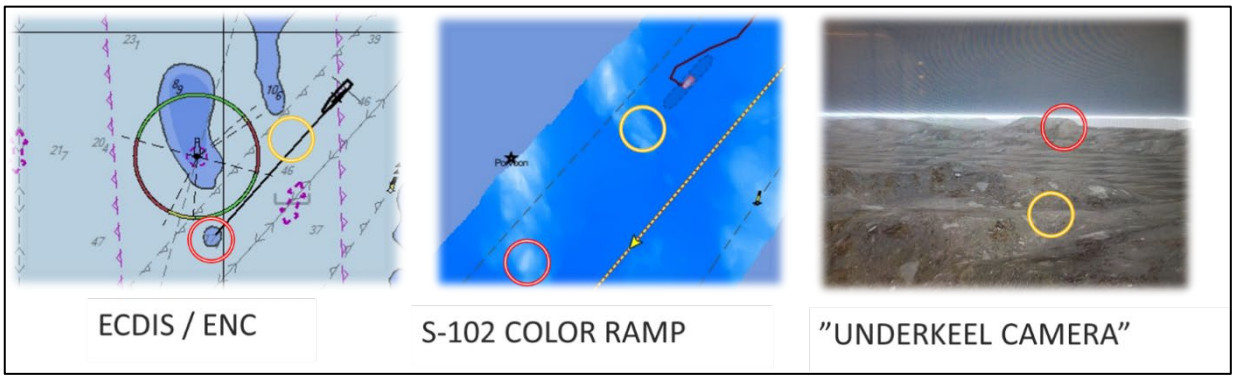


Image above: Print screen shots of the Image Soft Bridge Simulator with the Bathymetric grid.

2.3 Water (Sea) Level Information

The Finnish Meteorological Institute provides real time Water Level Information and Water Level Forecasts along the fairways in the Finnish coastal waters. Currently the water level forecasts covers over a period of about two days and based on computer-based numerical sea models that model water movements in the Baltic Sea. The forecasts updates four times a day.

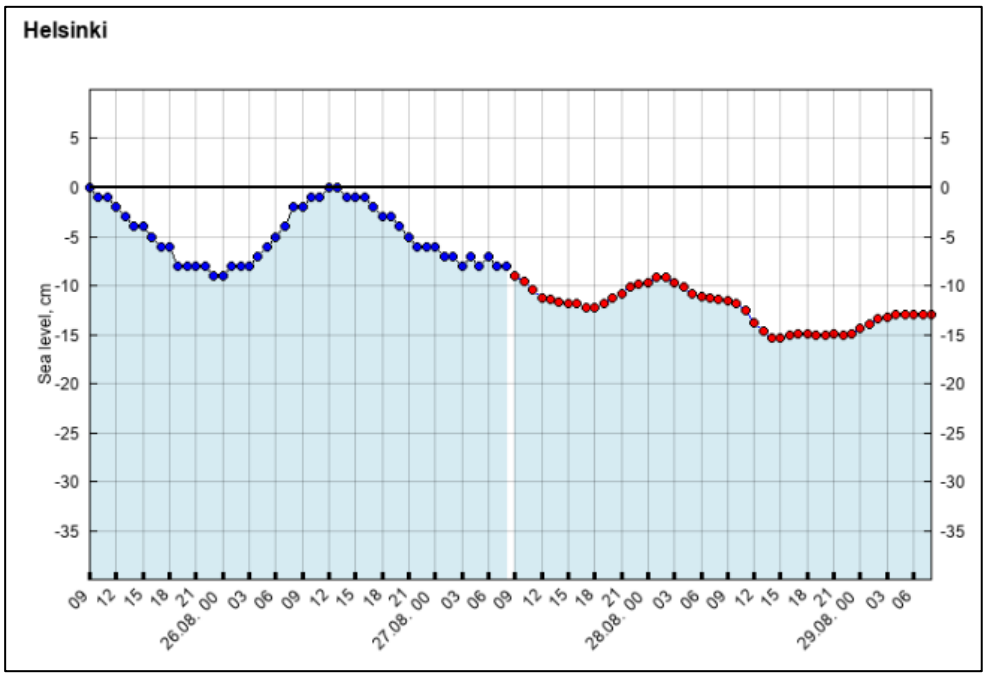


Diagram above: 2+2 day: The blue dots represent measured water level observations and the red dots are forecasted values.

Parallel calculations with different models and various parameters results water level forecasts up 5 days with a quite good reliability.

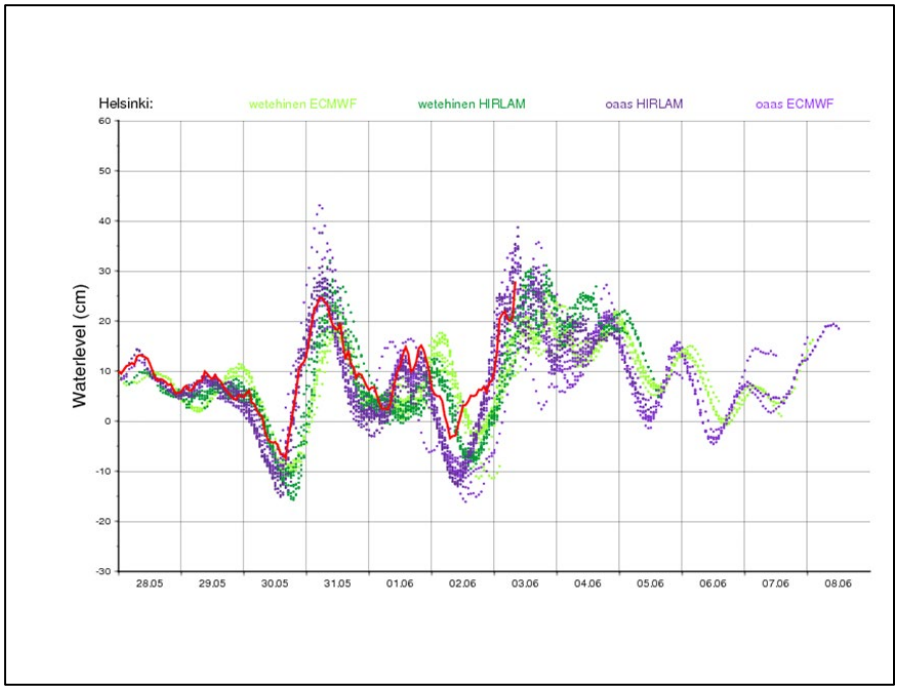


Diagram above: Forecast with different color represents predictions calculated with various models and parameters.

The project utilized these water level datasets and services in analysis where a route plan with optimized draft tested within different time intervals. The optimized route plan based on ENCs and Bathymetric Surface products.

3 Phase II, studies of interoperability

The focus of the second phase of the project was in exploring Bathymetric Surfaces in route planning and in real-time navigation. Objectives of the studies:

- visualise the BathyS products with the ENC in ECDIS like device
- explore interoperability of the BathyS and the Water Level Data
- examine how to utilise the BathyS and the Water level data in route planning and navigational risk analysis

3.1 OpenCPN

The research carried out through an application development using an OpenCPN software. OpenCPN is a Chart Plotter and Navigational software program for use underway or as a planning tool. OpenCPN is open source and free for users.

The visualization of the depth model in OpenCPN was successful. The project team developed a new plugin for reading and visualizing Bathymetric Surfaces in the OpenCPN. The plugin converted on the fly S-102 BAG format datasets into GeoTIFF files which then re-projected into UTM for a visual overlay together with ENC- data in WGS84."

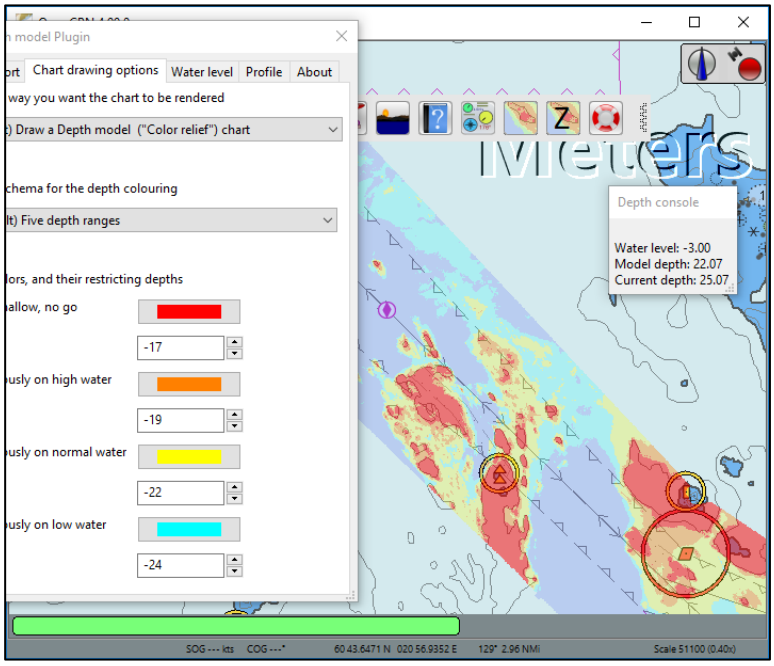


Image above: Bathymetric Surface with ENC data visualized by OpenCPN with FHO plugin. User specified color ramps illustrates GO/NOGO areas with given safety margins and corrected with real time water level information.

The software present the BathyS with the ENC data in a semi-transparent way, but more sophisticated integration or enhanced interoperability between the BathyS data and the ENC require more study in the future.

The resulting plugin for OpenCPN is available for testing and further development (https://github.com/FihoFi/OpenCPN-testbed).

4 Actions for the ARHC 9th meeting

- Note the report