How the Port of Hamburg became ‘Mega-Ship Ready’

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The Port of Hamburg is one of the biggest hot-spots for the movement of goods in Germany, and Europe’s second largest container hub. In 2013, around 130 million tonnes were handled at Hamburg in seaborne foreign trade. Container throughput was the strongest segment of this, with 9.3 million TEU handled over the year. Since 2006, the number of ultra large vessels (which are at minimum 330m long and 45m wide) calling at the Port of Hamburg increased from 621 to 989. This figure includes not only container ships, but also bulk carriers and cruise ships, as well as other vessels. Therefore, each ship is subject to unique restrictions when navigating the estuary to and from Hamburg, and the different restrictions are subject to changes in water level in the river Elbe or the width of the navigation channel leading to the port.

The dimensions of mega-ships call for a special nautical knowhow in the run up the Elbe towards the port, something possessed by the Elbe and Port of Hamburg pilots after extensive training. For turning and berthing within the port, Hamburg-based tugs are there twenty four hours a day to assist where and when required. Each terminal at the port has optimised each of its berths and gantry cranes for mega-ships so that the mass of containers can be handled rapidly and efficiently. The key to handling the vast amount of containers coming off a mega-ship is through coordinated working processes and cutting-edge IT.

Terminals tackle 18,000 TEU ships

Hamburg first took delivery of a sizeable vessel at the HHLA Container Terminal Burchardkai, which is operated by Hamburger Hafen und Logistik AG, when the fully cellular American Lancer containership model was given clearance on May 31, 1968. While remaining fully operational, since 2005, this facility has been fundamentally modernised, partly automated and redeveloped in order to facilitate the new era of mega-ships.

However, it is important not to stand still in this ever-evolving industry, and 2014 saw the introduction of five additional jumbo container gantry cranes which are capable of handling two 40 foot, or four 20 foot, containers simultaneously put into service. This meant the Burchardkai terminal marked an important milestone in its long-term expansion program, as it is now capable of handling ships of 18,000 TEU. Parts of the container yard were also switched to automated block storage, with HHLA Container Terminal Altenwerder as the model.

By the final stage of redevelopment, Burchardkai had boosted its total capacity from 2.6 million to around 6 million annual TEU throughput. The synergy of tandem gantry cranes, a new control stand with its integrated terminal control, and storage blocks has created an atmosphere for optimal performance in handling mega-ships.

Stringent conditions on the Elbe

Well defined and stringent practices are especially required on a restricted traffic route such as the Elbe. Shipping safety is of paramount importance. Close cooperation and coordination of all those involved in ship traffic is the basic prerequisite for nautical safety during passage up and down the river, as well as in port.

In the case of mega-ships, the VTS-Centre of the Hamburg Port Authority (HPA) stays in constant contact with the VTS-Centre in Brunsbüttel and Cuxhaven in order to meticulously control traffic. This is necessary since mega-ships cannot pass each other due to the width of the fairway 50km down towards the town of Glückstadt, and from there, the Elbe widens and farther on the characteristic estuary emerges on the German Bight and flows into the North Sea.

Vessel traffic services

The vessel surveillance system implemented by the HPA at Hamburg is a key component of its navigational safety policy. Internationally known as VTS, the system is used to monitor vessel traffic in the port and on the River Elbe, and it comprises a wide range of technical sub-systems, including:

- A land-based radar chain in the Port of Hamburg
- An AIS base station
- A coastal radio system
- Various meteorological and hydrological sensors that the HPA installed throughout the port area. The data collected by the equipment listed above is transmitted to the VTS Centre.

The VTS Centre provides the following:

- Information services: the VTS Centre captures all data relevant to vessel traffic in the port and communicates it to shipmasters (if required)
- Traffic organisation services: VTS operators predict and regulate traffic flows to prevent the occurrence of dangerous situations
- Navigational assistance services: on request, VTS operators will help vessels to safely navigate the port. They may give directions
or instructions to shipmasters if necessary to prevent incidents and/or risky situations.

State-of-the-art IT
Terminal operators, pilots and the HPA all use electronic aids to ensure the most effective possible use can be made of the tidal ‘window’. The tools utilised consist of ECDIS, the electronic sea charts published by the Federal Maritime and Hydrographic Agency (BSH) in Hamburg, and all those involved in operations are linked via PRISE, the Port River Information System Elbe, that is made available by DAKOSY, an IT system utilised by the port community.

The new IT platform displays all process changes in real-time. Unique in the world, the system is simplifying planning of passage along the Elbe and of ship movements in the Port of Hamburg. It was initiated and financed by terminal operators HHLA and Eurogate. PRISE assembles data from the ship approach and departure areas and makes these available to entitled participants such as handling terminals, tugboats, port and Elbe pilots, linesmen, agents and the HPA.

Among the status data included within PRISE is terminal berth planning and reporting, data on ship positions on the Elbe, ship reports by Elbe pilots, reports on which tugboats and linesmen have assumed responsibility for a vessel, and water level predictions from the Federal Maritime and Hydrographic Agency (BSH).

Even if the number of ship movements increases, the great efficiency of ship handling in the Port of Hamburg will be maintained and improved thanks to PRISE.

Turning circle for mega-ships
For pilots and tugs, turning mega-ships as if ‘on a pin’ in minimum time presents a great challenge. At Hamburg powerful state-of-the-art craft are deployed for this. By in-filling basins at the Container Terminal Tollerort, the HPA will expand the turning circle, while it is also planning a larger turning circle for containerships as part of the upcoming Western extension of the Eurogate Container Terminal in Waltershofer docks. The process of turning these ships in the Elbe before entering Parkhafen could then be transferred deeper into the port for the benefit of ship traffic and easing congestion.

Pilots training on a simulator
Pilots occupy a key position in ship traffic in the Port of Hamburg and on the Elbe. They ensure the safety of ship traffic round the clock and in all weathers. For training purposes, pilots practice on a ship simulator for all conceivable traffic scenarios. The Marine Training Center (MTC) in Hamburg-Stellingen has a unit of this type. Here, the HPA make careful preparations and calculations with the pilots for the arrival of new ship types. The MTC permits simulation of various different ship bridges, and the aim is to approach real operational scenarios as closely as possible. With the shiphandling simulator, precise calculations are made for the relevant ship type regarding the repercussions of very different wind strengths, currents, ice floes, fog, and complex situations on the Elbe or in port. Along with the HPA, the pilots then process the simulation variants to draw up a customised deployment plan.

About the author
After completing his studies in computer science and the supplementary subject of economics at the University of Hamburg, Jens Meier started his professional career at Software Design & Management AG with the Ernst & Young group.

Since 2008, Jens Meier has been serving as CEO of the Hamburg Port Authority.

About the organisation
The Hamburg Port Authority has been providing future-oriented port management services since 2005. As an Institution under Public Law, the HPA is in charge of paving the way for the efficient, resource-friendly and sustainable preparation and implementation of infrastructure projects in the port. The HPA is the contact point for all kinds of questions concerning the waterside and the landside infrastructure, the navigational safety of vessel traffic, port railway facilities, port property management and the economic conditions within the port area. The HPA ensures the provision of land as required, carries out all statutory duties placed on it and provides port industry services.

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