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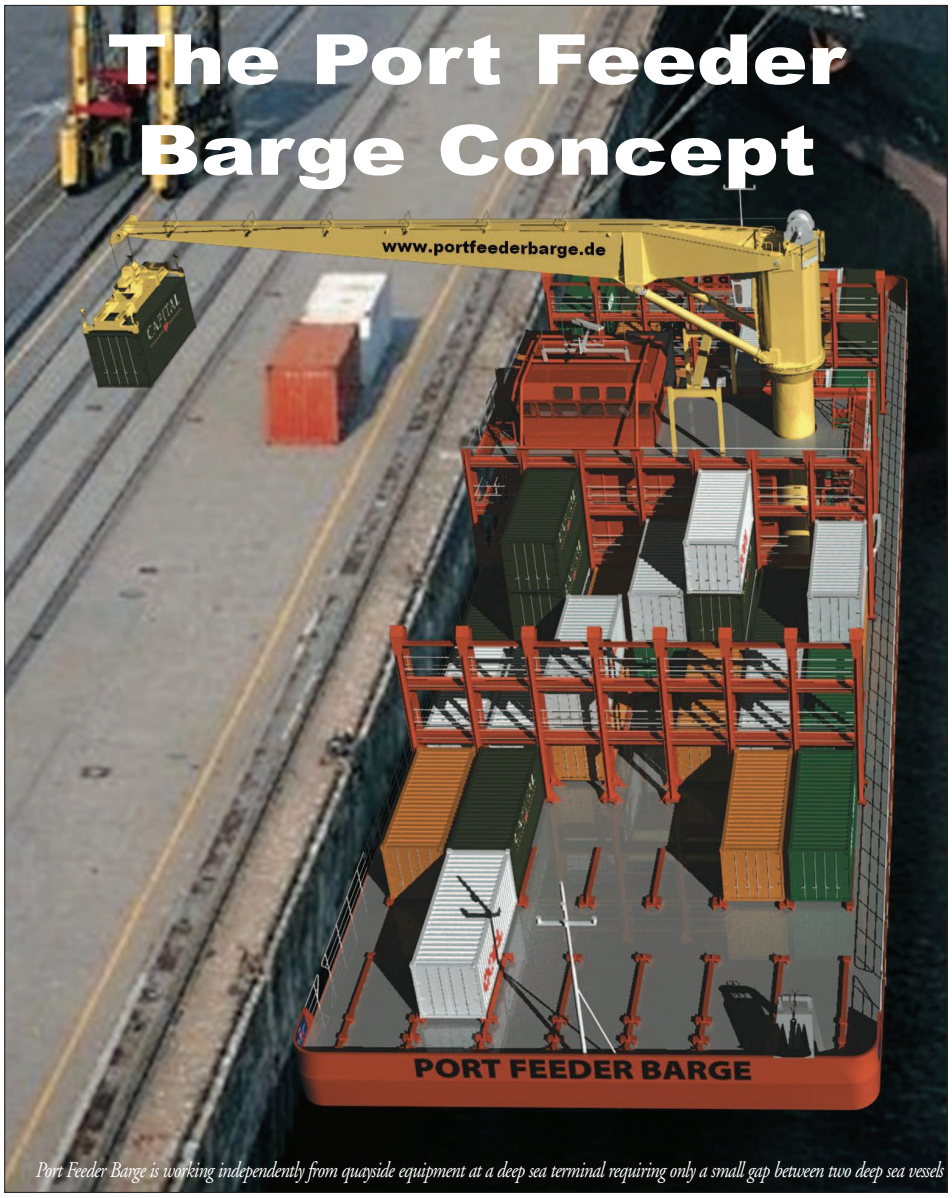
The Port Feeder Barge Concept



Port Feeder Barge is working independently from quayside equipment at a deep sea terminal requiring only a small gap between two deep sea vessels

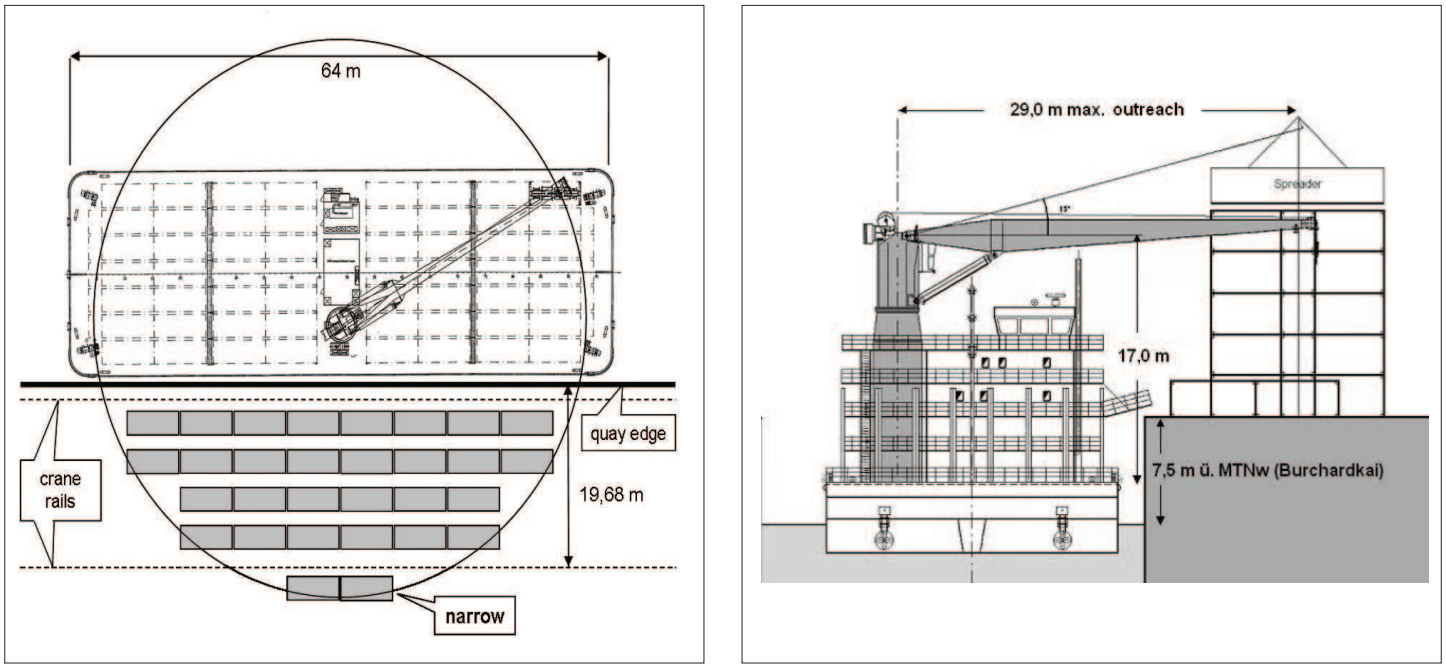
At the recently held Ports & the Environment conference in Amsterdam, Ulrich Malchow, Professor at the Hochschule Bremen University of Applied Sciences in Germany introduced a new type of harbour vessel that will revolutionise ship-to-ship or ship-to-shore container transportation within a port.

The internationally patented Port Feeder Barge concept is a self-propelled container pontoon with a capacity of 168 TEU (completely stowed on the weather deck), equipped with its own state-of-the-art heavy-duty container crane mounted on a high column. The crane is equipped with an automatic spreader, extendable from 20ft to 45ft, including a turning device. A telescopic over-height frame is also carried on-board. The barge is of double-ended configuration, intended to make it extremely flexible in connection with the sideward mounted crane. Due to the wide beam of the vessel no operational restrictions (stability) for the crane can occur. The crane has a capacity of 40 tonnes under the spreader, at an outreach of 27m (maximum outreach is 29m). The vessel is equipped with 2 electrically driven rudder propellers at each end in order to achieve excellent manoeuvrability and the same speed in both directions. Hence the vessel can easily turn on the spot. While half of the containers are secured by cell guides, the other half is not, enabling the vessel to carry containers in excess of 40ft length as well as any over-dimensional boxes or break-bulk cargo. For overnight stowage of electrically driven temperature controlled containers 14 reefer plugs are available. A diesel- or gas-electric engine plant with very low emissions has been chosen to supply the power either for propulsion or crane operation. The vessel can be operated by a minimum crew of 3 while a total of 6 persons can be accommodated in single cabins. When berthed, the PFB is able, without being shifted along the quay, to load or discharge 84 TEU in three layers between the rails of a typical quayside gantry cranes. The height of the crane column is sufficient to serve high quays in open tidewater ports even at low tide while stacking the containers in several layers (or to serve even deep-sea vessels directly). Due to its short length of 64m the PFB needs only a small gap between two deep-sea vessels for self sustained operations. The application of the barge is not limited to seaports. As the hull is classified according to Germanischer Lloyd's class notification for seagoing vessels the operation in (sheltered) open waters off the coast is also possible which opens some interesting opportunities for additional employment. With this barge concept Malchow has been concentrating on the benefits of using it in his home town of Hamburg where he sees the barge being employed in three business fields offering a daily liner service "round-the-port" (to be booked even for single boxes).

Intra-port haulage

The PFB can serve as a 'floating truck' in the course of its daily round voyage throughout the port shuttling containers between its various container facilities. Hence container trucking within the port can be substantially reduced. It is estimated that in 2011 within the port of Hamburg approximately 300,000 containers (i.e. approximately 85% of the anticipated entire volume) have been transported by truck (which is corresponding to approximately 450,000 TEU). The remaining 15% was transported by ordinary barges. The reason for the poor share of barge transport is very simple: conventional inland barges or pontoons employed in intra-port container transportation are dependent on the huge quayside gantry cranes for loading/discharging. However one move per gantry is already exceeding the costs of the

Port Feeder Barge (computer rendering)



Turning circle of crane + outreach of crane

entire trucking. Naturally two moves are needed and the barge has to be paid as well. Hence in most cases intra-port barging of standard containers is not competitive unless the 'lifts' by the quayside gantries are subsidised by the terminals. According to industry sources a third of the road haulage is of 'terminal-to-terminal' nature while more than half is between a terminal and an off-dock facility of which many have their own water access. Hence the present cargo potential for the PFB is estimated to roughly 150,000 containers annually (approximately 225,000 TEU).

Feeder operation

In general, feeder services accept and deliver containers from/to all facilities where deep-sea vessels are berthing. For this reason it is possible that feeder vessels have to call at several terminals within the port and sometimes only a few boxes are to be handled. For example in Hamburg each feeder vessel has to call on average at 4 different locations (including waiting at berths). That is why the feeder lines opted to transport the containers by road and have become major customers of the road hauliers. Otherwise their number of calls within the port would have been much higher. From the terminal's perspective all vessels with less than approximately 100 boxes to handle are critical with respect to profitability. However, in Hamburg alone almost two thirds of all terminal calls by feeder vessels are below that figure! While the feeder lines are already big customers of the trucking companies for intra-port haulage the barge concept can replace the use of trucks for collecting and distributing containers. The concept will offer a more competitive service than trucks can do, especially for over-dimensional boxes (flat beds with width/height restrictions). Hence the PFB can be used by the feeder lines more intensively than trucks enabling the feeders to concentrate on the major terminals only, thus reducing the number of calls of the feeder vessels, reducing their time in port and related costs, improving safety as well as increasing terminal and berth efficiency.

Inland navigation

Inland navigation is facing a dilemma as far as the hinterland transport of containers to and from seaports is concerned. Inland waterway vessels have to berth at the facilities which are tailor-made for the biggest container vessels (with a capacity of 14,000 TEU and even more). Hence the efficiency of the big gantry cranes is rather low when serving small inland vessels and explains why these vessels are the last priority when it comes to berth allocation. Also inland barges suffer more than feeder vessels as they have to call at even more facilities. For example Rotterdam has approximately 30 terminals and depots which are frequently served by inland container barges. The average number of terminal calls per vessel is about 10 whereas in about 50% of the calls only less than 6 containers are handled! This kind of inefficient and uncoordinated 'terminal hopping' is very time consuming and each delay at a single terminal results in incredible accumulated waiting time during the entire port stay. In Hamburg where inland navigation has still only a share of less than 2% in hinterland container transport the inefficient operation has been identified as one of the major reasons for such a small share. Some Dutch and German studies have already been published and one common result is that container handling for inland navigation and deep-sea vessels should be separated from each other. In other words: Inland vessels should not call at the deep-sea facilities anymore. It is claimed that dedicated inland waterway berths have to be introduced at these deep-sea terminals. However most terminals do not have any shallow draught waterfront left where such berths could be arranged. Transforming existing valuable deep-sea quays to exclusive inland navigation berths with dedicated (smaller) gantry cranes does not pay off for the terminals as such a measure would reduce their core revenue earning capacity. The PFB could act as a dedicated 'floating terminal' for inland navigation. During its daily round voyage throughout the port the vessel is collecting and distributing the containers also for inland navigation. Once a day, the PFB can call at a dedicated berth to meet with the inland barges where the containers are exchanged ship-to-ship by the vessel's own gear, independently from any terminal equipment (virtual terminal call). Not even a quay is required but the trans-shipment operation can take place somewhere mid-stream.

Further applications

The PFB can also assist as an emergency response vessel. For example when container vessels are grounded in coastal zones they mostly have to be lightered very quickly to set them afloat again in order to avoid further damage to the vessel, the environment and in extreme cases to sustain even the accessibility of a port at all. Unlike some other heavy floating equipment, the PFB can navigate in very shallow waters due to its light ship draught of only 1.2m. The barge can also be employed as a floating crane for any kind of cargo other than containers.

Mid-stream operations

In Hong Kong approximately a third of the huge port's container throughput relies on floating units serving deep-sea vessels directly while anchored. These traditional but unique mid-stream barges are equipped with their own cargo gear, but the handling method is far from being sophisticated. The A-frame derricks have a single beam just controlled by wires and are not even fitted with a spreader, but instead rely on steel wires being fitted manually to the comer castings of the containers. In fact this is cargo handling technology from the 1950s and hardly complies with international port labour safety standards. Such mid-stream barges are only operating in Hong Kong (except for a few in Angola). On average 4 fatal accidents are officially reported each year. The PFB would significantly improve such operation with regard to safety, efficiency, speed and accessible ship sizes.

Urban issues

With respect to investment, availability of land reserves, construction approval, flexibility, and not to forget environmental issues, operating the PFB doesn't require 'heavy' land-based investments to operate. In addition, the barge can operate on LNG as fuel source resulting in elimination of all costly measures to keep exhaust emissions of the diesel-electric engine plant at an envisaged minimum (for example exhaust scrubbers, urea injection, filters etc.) By using LNG the PFB would not rely on a network of bunkering stations. Only one facility is sufficient and at the initial stage the barge could be supplied by an LNG tank truck (sufficient for approximately 14 days of operations). Due to its pontoon type there is plenty of void space below the weather deck for the location of the LNG tanks.

> "The Port Feeder Barge concept is a 'green logistic innovation' for sea ports (whose inherent beneficial effects to the environment can even be further increased by using LNG) that helps to shift container trucking within sea ports from road to waterway, ease feeder operations within multi terminals, improve the intermodal connectivity of inland navigation and act as an emergency vessels for grounded container vessels."

Conclusion

The Port Feeder Barge concept is a 'green logistic innovation' for sea ports (whose inherent beneficial effects to the environment can even be further increased by using LNG) that helps to shift container trucking within sea ports from road to waterway, ease feeder operations within multi terminals, improve the intermodal connectivity of inland navigation and act as an emergency vessels for grounded container vessels. WPD

The Port Feeder Barge is serving an inland barge midstream (computer rendering)