BIG SHIPS, DEEP CHANNELS AND TRANSFER TERMINALS

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The Port of Valencia has recently announced plans for a large, new US$1.4 billion terminal, with a 2-km berthing dock and 140-ha terminal area. Beside its sheer size, the most striking feature of this terminal is its depth: 20 metres (m), that’s the same as new Rotterdam’s Masslakte II terminals. Evidently, a depth of 20m is becoming the new norm for major hub ports gearing themselves to handle the big ships of the future. The two European ports are able to provide such deep channels due to their open-sea locations. Most ports worldwide are river ports with depth-constrained channels. These include the ‘rising star’ of US ports, the Port of Savannah, its case is used in this paper to re-introduce a not-so-new concept to cope with channel depth – Transfer Terminals (TT).

THE PORT OF SAVANNAH
The main container terminal of the Port of Savannah is the Garden City Terminal (GCT). GCT is the largest terminal in the US, with 3km of berthing dock and close to 500ha of terminal area, 1.5–2 times larger than the above-mentioned European terminals. GCT also has state of the art facilities, including the largest intermodal yard in the US (and probably worldwide) which, when competed, will be able to handle two, 3km (10,000 ft), 600+TEU, double-stack unit-trains. The capacity of GCT’s current facilities, as well as its throughput, is about 4 million TEU; with additional equipment, it can be doubled reaching 8 million TEU. A cursory review indicates the availability of sizeable developable waterfront areas nearby GCT, which could further increase capacity of the upriver complex. In fact, the availability of vast developable area near GCT induced the development of a huge cluster of distribution centers, which, in turn, fueled GCT’s tremendous growth.

GCT is located 22 nautical miles upriver, at the head of the deep-water navigation of the Savannah River, a narrow, sediment-prone and meandering river. The current depth of the river is 12.8 m; an underway $1-billion deepening project, to be completed in 2021, will increase the depth to 14.3m. The primary shipping services calling at GCT are Asia/Panama/USEC, popularly defined as All-Water Panama (AWP) and the Asia/Suez/USEC, defined as All-Water Suez (AWS). The largest ships deployed on AWP are 14,000 TEU, New-Panamax (NPX), with their draft, 15.2m determined by the new Panama locks. Assuming, conservatively, 1m under-keel,
fully-loaded NPXs require a channel depth of 15.2m – 1.3 m beyond the future depth of Savannah River.

Despite its depth limitations, GCT already handles NPX ships, either partially-loaded, or riding the tide, or both. NPXs also are the largest ships deployed on AWS services. But, since AWS’ rotation is similar to Asia/Europe services, it is reasonable to expect that AWS services will attempt to deploy 20,000+ TEU ships similar to those already deployed on Asia/Europe services, and perhaps even larger ships, for which Valencia and Rotterdam prepare with their 20m channels. But 20,000 TEU ships attempting to reach GCT, even with its future 14.3m channel, will face severe constrains in water draft, air draft and channel width.

JASPER OCEAN TERMINAL

Realizing the problems due to GCT upriver location, the Port of Savannah, together with its neighbour to the north, the Port of Charleston, decided to develop a new greenfield terminal, the Jasper Ocean Terminal (JOT) at an estimated cost of $4.5 billion. JOT site is 10 nautical miles (NM) downriver from GCT and 12NM upriver from the river mouth. Accordingly, JOT will have the same depth as GCT (14.3m), well below the 20m required for major future hubs. Further deepening of the River, even just the first 12-NM section up to JOT, are likely to face almost insurmountable obstacles. Moreover, if only this section is deepened and JOT constructed – what will be the fate of GCT? Will this huge, state-of-the-art complex, representing cumulative local and federal investments of about $3 billion, be turned obsolete? Another problem in relocating GCT’s maritime activity downriver to JOT is the additional land transportation cost incurred by the huge cluster of distribution centers located around GCT.

TRANSFER TERMINAL

One way to save GCT, and delay or even avoid the development of JOT, is by developing a special deep-water transfer terminal outside the river in the sheltered ocean area between the jetties (breakwaters) protecting the channel’s entrance. Figure 1 shows the locations of the three Savannah river terminals: the Garden City Terminal (GCT), Jasper Ocean Terminal (JOT) and the proposed Transfer Terminal (TT). Figure 2 shows a schematic design of the envisioned TT. The TT is a detached dock with ship-to-shore (STS) cranes similar to those in land-based terminals, except for their extended back reaches, allowing them to transfer boxes directly between ships and river barges. The dock structure itself can be fixed, based on piles or caissons, or floating, if located in very deep water. The dock space in-between crane legs is used for temporary storage of hatch-covers and moving boxes along ship for re-handling. The water space underneath the back reach is used for barges. A system of pullies shifts and positions barges to align them with ships’ hatches. The TT’s operation is essentially ‘dumping’ of boxes from ships to barges and vice-versa, providing for a high productivity. The productivity could be further enhanced by using automated, high-speed STS’s, triple-tandem spreaders (6 TEU), dual hoisting, automated conning platforms and, in the future, doubling crane density by using an APMT Fastnet-like structure. The main challenge for direct transfer, matching stowage plans of ships and barges, seems attainable with the advance of XVELA, encompassing stowage plans of all ports In ships’ rotation.

TRANSFER VS. TRANSshipment TERMINAL

The ship/barge exchange at the TT is simple, involving a single mothership and barges, with all boxes to/from a single port (Savannah in this case). The TT should be contrasted with a transshipment terminal, where the ship/barge exchange involves multiple mother and feeder ships arriving at different times with boxes to/from multiple ports. Indeed, the ship/barge transfer at a transshipment terminal requires a CY, serving as an intermediate buffer, as well as 4 lifts, to/from and at the CY; the direct ship/barge transfer at a TT does not require a CY and only involves 1 lift. Accordingly, the cost of a transfer move at a TT should be a fraction of that at a transshipment terminal.

The TT concept, as noted above, is not new and a rudimentary version of it, based on crane barges, has been in operation for many years in Hong Kong. Likewise, in
New Orleans (and elsewhere), floating and shore cranes have been used to transfer containers between ships and barges. The novelty in the TT envisioned here is that it is much more technologically advanced and designed for handling big ships with massive ship/barge transfer operation of 10,000-TEU per call. The river barges, as depicted in Figure 2, could be of various sizes and configurations. The two types illustrated in this figure are: (a) small 100-TEU barges, to be combined into trains (flotillas) and moved by push-tugs as presently practiced on the Mississippi River; and (b) large 2,500-TEU self-sustained barges. Boxes are stowed on both barges in a fixed cell structure, eliminating the need for locking.

There are two generic applications of TTs, for:

- **Partial Transfer** (Lightering) – The mothership discharges part of its cargo onto barges at the TT, lightens its load and reduces its draft so it can reach the upriver terminal, where most of the cargo exchange will take place; or
- **Full Transfer** – The mothership only calls at the TT, where its entire load is exchanged with barges.

The second application is of special interest since it eliminates a costly trip of the mothership upriver, including pilotage, tuggage, delays due to one-way navigation, pleasure boats, etc. The barges also serve as a buffer, easing the impact of the surge created by big ships. Using shallow-draft barges opens up new possibilities of developing shallow, upriver waterways with European-style, single-crane low-cost barge terminals, increasing the capacity of the port complex. Generally, the main advantage of TTs is possibility of separating of ship and terminal handling, with the first performed at a deepwater, detached dock and the second at a shallow-water, land-based terminal(s) with CV, gates and road/rail connections.

### THE PORT OF HAMBURG

The main objective of TTs is preserving existing port infrastructure especially for river-based ports. TTs could be introduced worldwide: in North America, at New York, Charleston, New Orleans, Houston and Montreal; in South America at Santos, Guayaquil and Buenaventura; and in Europe, at Antwerp and, especially, Hamburg. Hamburg has a 14.2m channel, increasing to 15.6m when the recently-approved dredging of River Elbe completed in 2020. Hamburg’s future channel is quite deeper than Savannah’s future channel of 14.3m. Nonetheless, Hamburg’s situation is much more precarious than Savannah’s because of its: (a) longer channel (44 vs. 22 NM); (b) stronger local opposition to dredging; (c) lack of potential downriver terminal sites (like JOT); and, most importantly, (d) facing a formidable competitor, Rotterdam, with 20m, which has already been grabbing market share from Hamburg. It seems therefore, that irrespective of its new channel, Hamburg should be seriously studying a TT-like system (Cuxhaven?). A word of caution, while the TT concept appears technologically simple, it has to be further developed and its economics carefully assessed, taking into consideration the specific circumstances of each port.

### FINAL THOUGHTS

The history of container shipping seems to be a never-ending confrontation between shipping lines periodically coming up with bigger ships, and ports forced to come up with deeper channels. The concept of TTs, if proven viable, has the potential to “save” many ports unable to provide deeper channels due to their upriver locations and therefore facing the risk of being bypassed by future big ships. But, the concept of TTs, based on the separation of ship and terminal operations, may also imply to many open-sea ports, especially if McKinsey’s prediction of 50,000 TEU ships, requiring 20+ m channels, realized. Altogether, I believe that TTs will play an important role in the future evolution of the shipping and port industry.

Before concluding this paper, I can’t avoid an intriguing question: why TTs have not been considered thus far as an alternative to river deepening? TTs could have saved not only the huge cost of dredging, but also the bitter and long approval process. 16 years in Savannah and 17 years in Hamburg. This raises another intriguing, or perhaps, harrowing thought: since the next round of river deepening is likely to face stiffer opposition, its approval time is likely to be even longer – another argument in support of TTs.

### ABOUT THE AUTHOR

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