

BOXBAY - THE FUTURE IS VERTICAL

NEW JOINT VENTURE INTRODUCING HIGH BAY STORAGE TERMINALS



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We believe container handling technology is set to take a huge leap forward thanks to BOXBAY, an international joint venture formed by global trade enabler DP World and industrial engineering specialist SMS group. BOXBAY has been created to offer new solutions for container storing and handling through its High Bay Storage (HBS) system—a disruptive new technology that significantly improves operations at container terminals. Instead of stacking containers directly on top of each other, which has been global standard practice for decades, BOXBAY places each container in an individual rack, making each one directly accessible. The storage capability of the terminals is thereby enhanced by stacking containers as high as 11 tiers. The system was originally developed by SMS group subsidiary AMOVA for round the clock handling of metal coils that weigh as

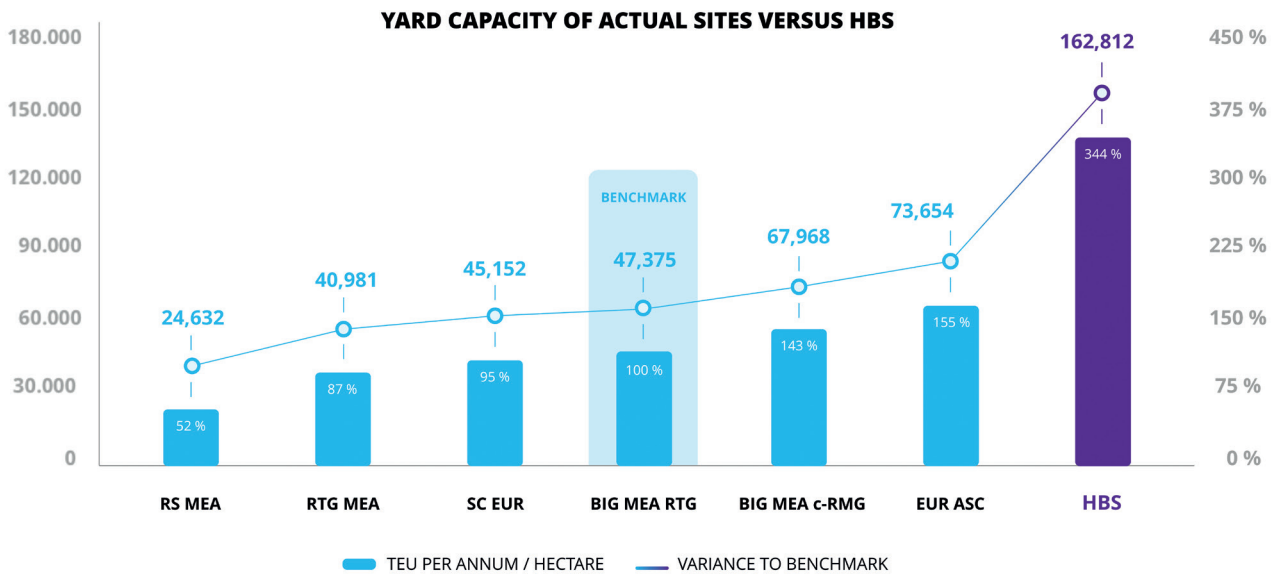
much as 50 tons each in racks as high as 50 metres. AMOVA is the first company to transfer this proven technology to the port industry.

CURRENT INDUSTRY CHALLENGES

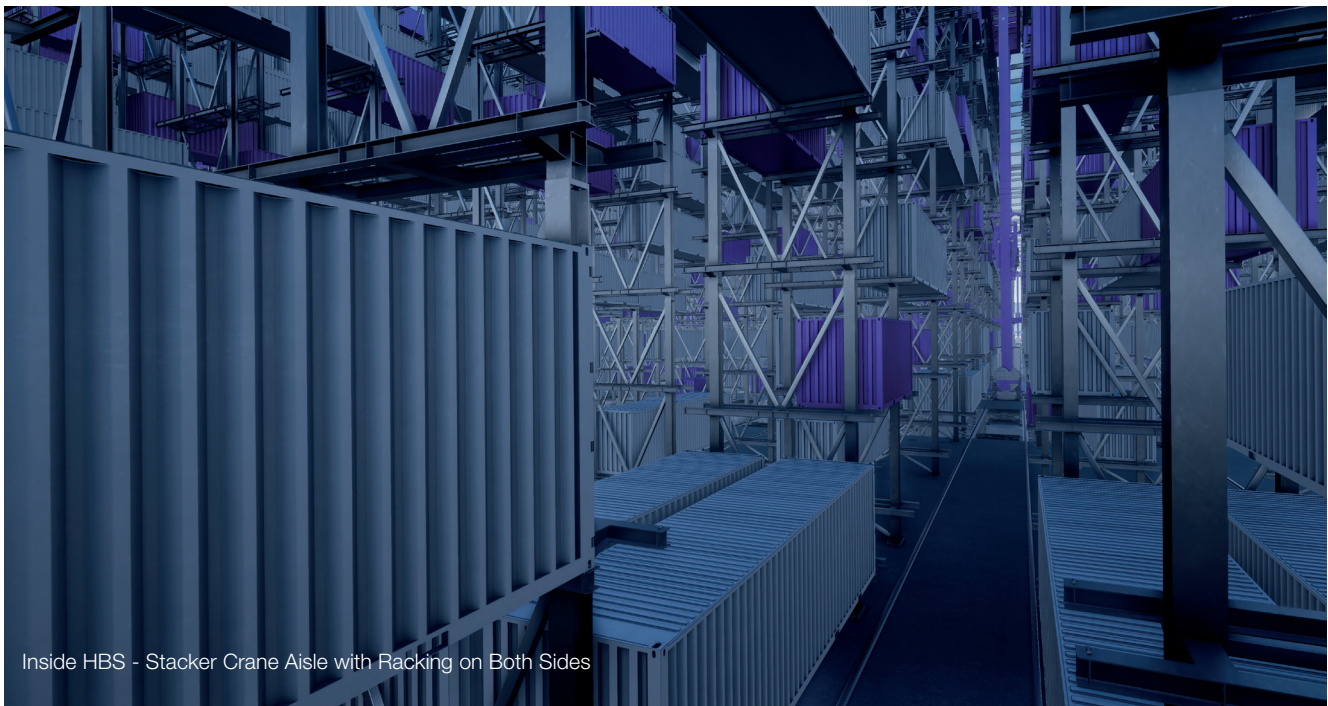
Operators of container ports face numerous challenges worldwide with many reaching high levels of utilization, limits to expansion, costly and lengthy environmental processes. Some are even forced to build satellite depots inland with all the associated disadvantages. Serving ultra-large container carriers (ULCC) is challenging as they require very high service levels with significant peak demands. Waterside productivity requires efficient solutions for faster handling above 200 containers per hour. Most yard operations often struggle to keep up with quay side performance due to the

complexity of planned yard strategy and equipment deployment in high utilized container yards, the BOXBAY solution simplifies and automates this operation and closes this disparity.

In 2002, Post-Panamax vessels of 7,500 TEU carried 220 containers per bay, yet in 2018 the ULCC brings 502 containers per bay. With this in mind, we began to ask the question, 'are our terminal designs still valid or is there a better way to serve the giants of the sea?' Today, port operators tend to stack containers higher in the yard, often 5 to 6 tiers high on top of each other, which leads to reduced performance levels once they reach over 80% yard utilization. The result – a big increase in unproductive yard shuffles, especially on less predictive landside operations to serve external trucks, trains and barges. Terminal yards are crowded places with



(Figure 1: Annual yard capacity per hectare storage area)



Inside HBS - Stacker Crane Aisle with Racking on Both Sides

vehicles often mixing with visiting external trucks. The complexity is magnified by shift changes with crew buses and supervisory vehicles – little wonder that most of lost time injuries originate from yard incidents.

In container terminal operating systems (TOS), the seamless scheduling of yard strategy (planned a week before vessels arrive) and the equipment dispatch of yard cranes and horizontal transport is one of the bigger challenges, often a coupled process (one equipment type waiting for the other to on/offload in order to continue). Use of yard cranes and horizontal transport is manual, with

operators equipped with pagers. Diesel engines also have a relatively short maintenance interval and the result can be a lot of idling coupled with a high CO2 footprint in a noisy environment and low operational equipment efficiency (OEE).

BOXBAY A HIGH BAY STORAGE SOLUTION

AMOVA and DP World have developed a High Bay Storage (HBS) system that integrates solutions for the automatic handling of ISO containers that cuts the yard storage space to a third of a conventional RTG yard. Fully electrified and automated aisle stackers interface to sea and landside points of work

through an innovative under floor container conveyor system. The aisles are placed parallel to the quay and serve the quayside operation from each end served by shuttle carriers. Meanwhile, land and waterside operations are integrated with the under floor conveyor system serving landside trucks. Instead of stacking containers on top of each other as before, they are now stored in individual compartments in a racking system, making them directly accessible, up to 11 stories high. This results in an increased yard capacity per hectare of over 300% compared to an RTG yard (see Figure 1).



HBS Waterside Interface for Shuttle Carriers

The technology is very modular and can be tailored to either brownfield or greenfield sites. It can also be easily linked to straddle carriers, auto shuttles, terminal tractors and autonomous trucks. We see a big market for brownfield retrofits as the HBS is so compact it can absorb a lot of capacity in a small land footprint enabling minimal business interruptions when the build phases come on line, the HBS can also be expanded step by step while the port is in operation, as the construction site takes up very little space.

BOXBAY BENEFITS

BOXBAY meets all terminal handling challenges. Being fully automated, it is much safer and with traffic segregated from the quay there is a much improved safety environment. There is no pedestrian interaction with maintenance and reefer personnel using separated walkways inside the store. Firefighting can be conducted with rooftop sprinklers as well as through special firefighting containers and remote controlled stacker cranes. On the landside, visiting trucks are handled on a "drive through" principle making it easier and safer for multi trailer systems to be offloaded and loaded at the end of each conveyor. The majority of the crane cycle is automated and only the last part of the truck handoff will be conducted by a remote controllers similar to auto C-RMGs.

Containers are stored in individual compartments up to 50 metres high in the racking system making them secure. Extension of yard capacity is unique in the industry with over 160,000 TEU per hectare a year resulting in boosted yard capacity or re-assigned spare land. The rack's design with each container directly accessible means the need for complex yard strategy and equipment dispatch can be left to the fully automated equipment control system and integrated warehouse management. The lack of yard re-handling moves enables the system to operate at near full utilization before there is loss of service level.

As the HBS output is consistent, quay cranes can be pushed to their limits reducing idling to a minimum. It is much easier to plan and perform underdeck quay crane dual cycle moves with shorter crane cycles and we anticipate a 20% improvement in quay crane performance levels. We have simulated peak performance of a 3.3 million TEU annual capacity high bay store and came close to performance levels of 400 two berth moves and near 300 landside containers per hour. This store is ready to handle ULCCs.

Being fully automated and electrified, it also reduces repair and maintenance costs, staffing, and maintenance by up to 20%, increasing the operational

equipment efficiency (OEE). The capex per TEU capacity is very close to conventional terminal concepts (a-CRMG and ITV), and the life cycle cost over 25 years is "best-in-class". We also anticipate less yard damage due to low probability of containers toppling while fully clad solar panel roofs and containers stored on small notches in the rack create a safer all-weather solution.

This concept is hard to match as a sustainable solution. Equipment is rail mounted. Electric power regeneration on the stackers and conveyors in addition to the solar power plant reduces the CO2 footprint to a minimum and can deliver back power to the grid. It reduces noise and light pollution which will help if alongside busy residential urban environments. The technology allows cities to use their expensive and sensitive land and waterfront areas more effectively while greatly improving the financial performance of container ports and their overall appearance.

THE DESIGN

The mechanical structure of the High Bay Storage warehouse has proven itself in the steel and aluminum industry for years with loads of up to 50 tons. The container HBS is designed for a great variety of 20-, 40- and 45-foot ISO containers where the loads are up to 35 tons for each container. All storage



Automated Truck Loading Interface



11 Stories HBS System with Shuttle Carrier

and retrieval operations are carried out by stacker cranes. Similar to current spreader operations, containers are picked from above by standard twistlock units. The stacker cranes pick up the containers at the ends of the respective storage aisles from the corresponding transfer positions or place them there again.

As a technical innovation, these stacker cranes can be crossed in the basement of the HBS and are able to pick up or set down containers from below their rail level. This makes it possible to integrate an underfloor transport system operating at a rectangular position to the travel direction

of the stacker cranes. The rail-bound pallet circulation operates independently of the movements of the stacker cranes without influencing their performance while the underfloor transport system acts as an additional dynamic buffer that decouples the stacker cranes from the truck loading stations landside.

THE PILOT PROJECT

A pilot project is currently under construction in Jebel Ali port in Dubai and will be unveiled at the Dubai EXPO 2020 World Fair from October 2020. The plant will show the many possibilities of a HBS

SUCCESSFUL TECHNOLOGY TRANSFER

With the HBS, AMOVA transfers their expertise from the design of heavy-load high bay warehouses in the metal industry to the operation of container terminals. Many elements of the HBS technology have been used for decades in similar applications in the steel and aluminum industries. The coils produced are as heavy as containers and must be stored between process steps in racks up to 50 m high so that they are quickly available again. The pallet circulating system, the stacker cranes and the control and management software also spring from similar technologies in rolling mills. HBS is an important innovation in the world of container terminals, building on existing, proven and mature technology.

and prove that technology originating from the steel industry can be used in container terminals. It will also show how the system is integrated into land- and water-side container handling. The pilot will feature containers being delivered by shuttle carrier. It can also deliver fully automatic loading and unloading of trucks while two stacker cranes take over the storage and retrieval of containers.

THE BOXBAY JOINT VENTURE

To make the new technology available to terminal operators worldwide, DP World Group and SMS group/AMOVA have founded the BOXBAY joint venture. The legal holding company is based in Dubai while development and engineering is carried out by AMOVA in Germany. With the partnership of an experienced terminal operator and a global major plant manufacturer, the competence for the operation of container terminals comes together with the know-how for the realization of comprehensive logistics solutions. An essential aspect is that SMS not only designs and manufactures equipment, but builds large industrial plants - for example complete steelworks - including complex automation and logistics solutions for many decades and is one of the pioneers in the digitalization of industrial processes.

ABOUT BOXBAY SHAREHOLDERS

DP World is a global trade enabler operating in 80 locations in 40 countries on six continents. It provides smart data driven logistics services for the benefit of everyone with expertise in ports and terminals; business parks, freezones and economic zones and maritime services adding value across the supply chain as products are moved from point of production to markets for consumption.

SMS group is a group of companies internationally active in plant construction and mechanical engineering for the steel and nonferrous metals industry. It has some 14,000 employees who generate worldwide sales of about EUR 3 billion. SMS subsidiary AMOVA GmbH has been a specialist in satisfying logistic demands in the metals industry for more than 60 years. AMOVA has been successful in translating the knowledge of these demands into other industrial sectors such as High Bay Storage systems for containers.

ENQUIRIES

www.box-bay.com