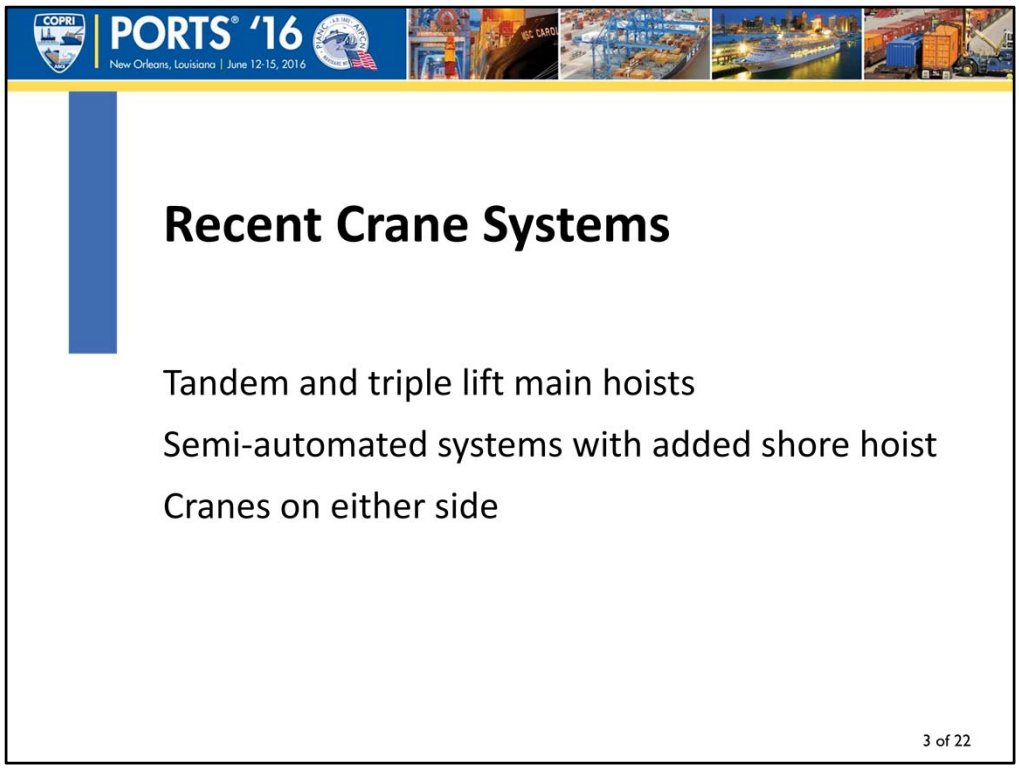
Liftech Consultants Inc. is a consulting engineering firm, founded in 1964, with special expertise in the design and procurement of dockside container handling cranes and other complex structures. Our experience includes structural design for wharves and wharf structures, heavy lift structures, buildings, container yard structures, and container handling equipment. Our national and international clients include owners, engineers, operators, manufacturers, and riggers.

Erik Soderberg is Liftech's president. He has over 20 years of experience in the design, review, and modification of a variety of structures including container cranes, wharves, heavy lift equipment, various rigging structures, and buildings. Erik has consulted on hundreds of cranes, participated in the design of over two dozen wharf structures, and has designed many crane transfer systems ranging from curved rails to shuttle systems. He has engineered repairs and modifications for dozens of container crane structures and for several bulk loaders. His field skills include an understanding of heat straightening techniques and the ability to develop repair procedures on-site.

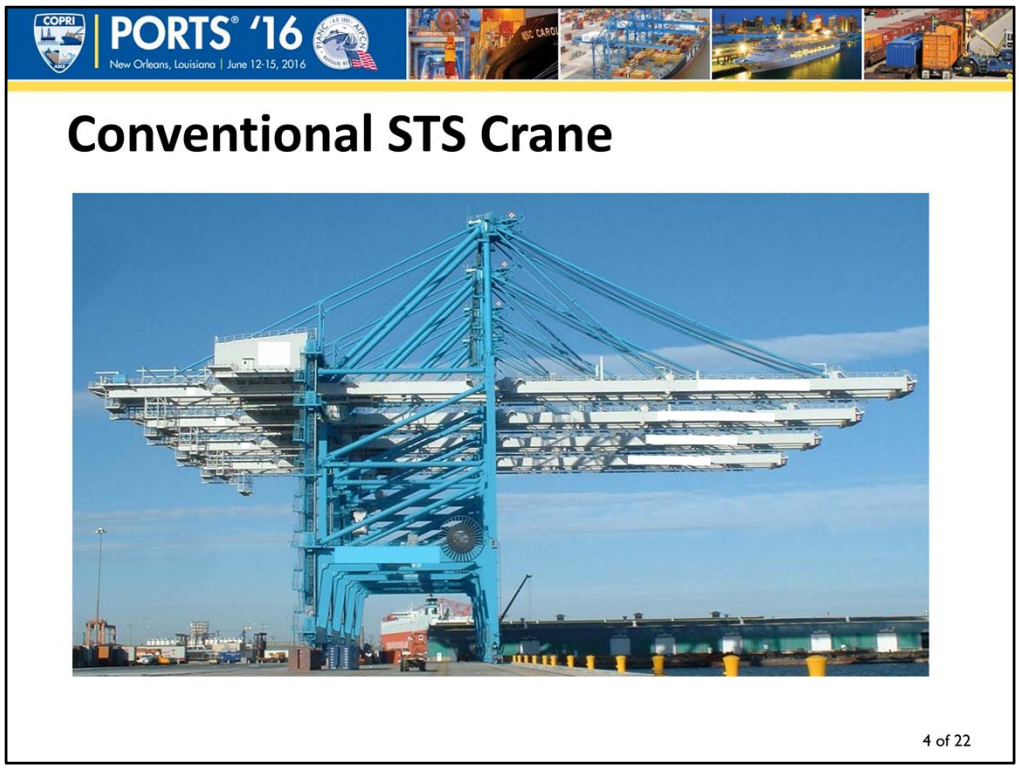
Container ship sizes now carry nearly 20,000 TEUs. However, most of this added capacity is due to increased container stacking heights and increased stack widths. Ships haven't gotten much longer, so the number of container cranes that can fit along the ship has increased little.

Increased container stacking heights and increased stack widths has resulted in increased demand in container crane productivity.

This presentation covers recent crane systems and concept crane systems that address the demand for increased crane productivity.



Recent high-productivity crane systems employ traditional machinery, but handle more containers at a time, have shore hoist systems to reduce the time the main hoist is required servicing the yard equipment, and/or work both sides of the ship.



The conventional ship-to-shore crane is available in a variety of configurations and machinery.

It has a single hoist and trolley.

Cranes operate at every other vessel hatch.

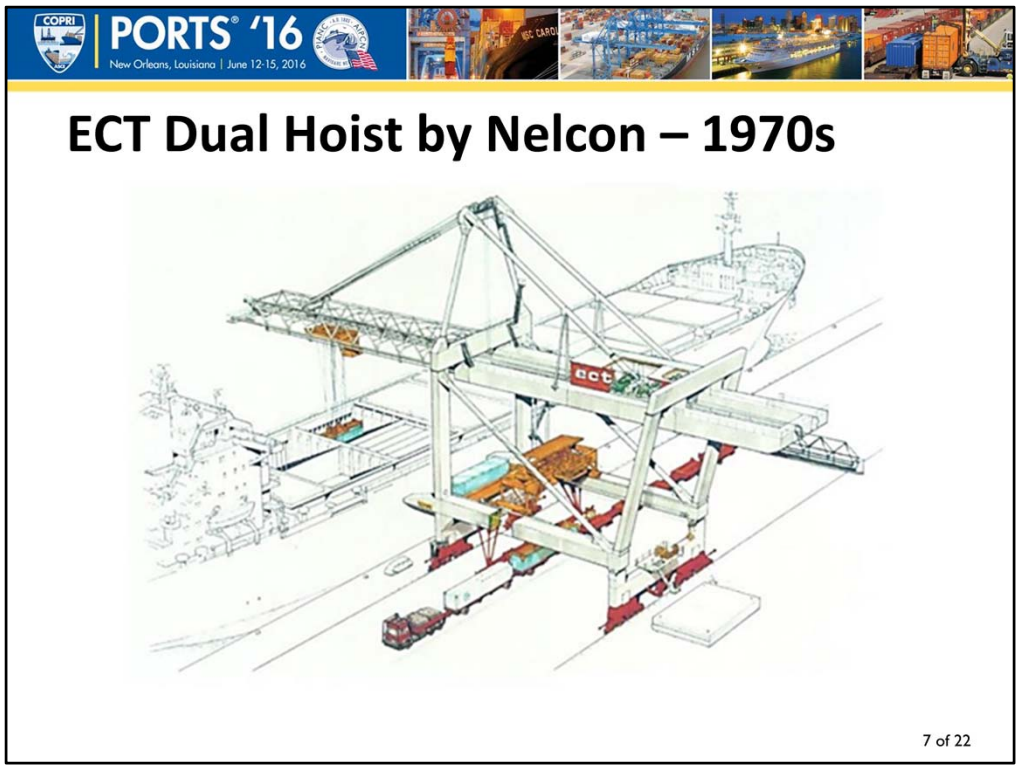
Hatch covers are placed landside of the landside rail.

It has some semi-automated features, but is manned controlled.

The slide shows a dual-hoist, tandem 40' lift crane. It can hoist 4x 20' containers or 2x 40' containers. It can also stow one hoist for 2x 20' standard operations.

Theoretical added productivity is often not realized due to the many complications of handling multiple containers. Control systems and more experienced operators will continue to improve productivity with this system.

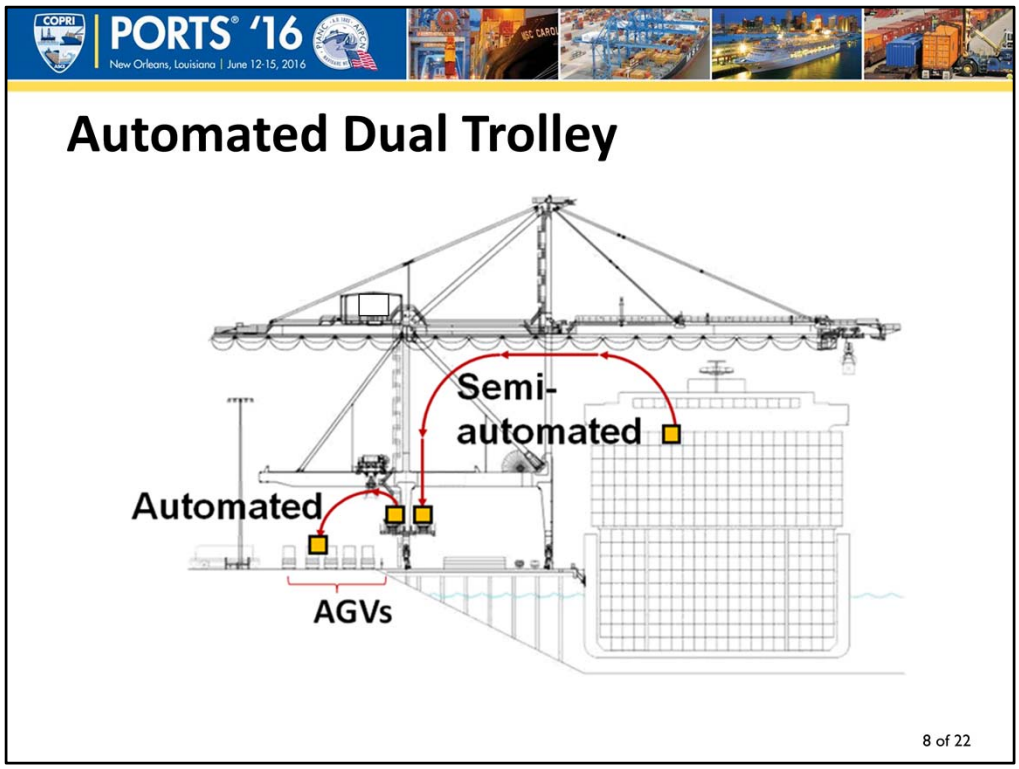
Triple spreader lift systems are not common. This slide shows a dual-hoist crane, with one standard headblock, and one separating tandem headblock.



Shore hoists were developed in the 1970s. Cranes with shore hoists were built in the 1980s, but these systems were typically ahead of their time and not used.

The one on this slide is a system developed by Nelcon that included a buffer platform on the waterside and second trolley that ran the length of the portal beam.

With the increased demand and with better control systems, similar systems are being built again.



This shows the typical arrangement for automated terminals. It sometimes includes the option for a tandem 40' lift ship trolley.

Hatch covers are stored between the legs.

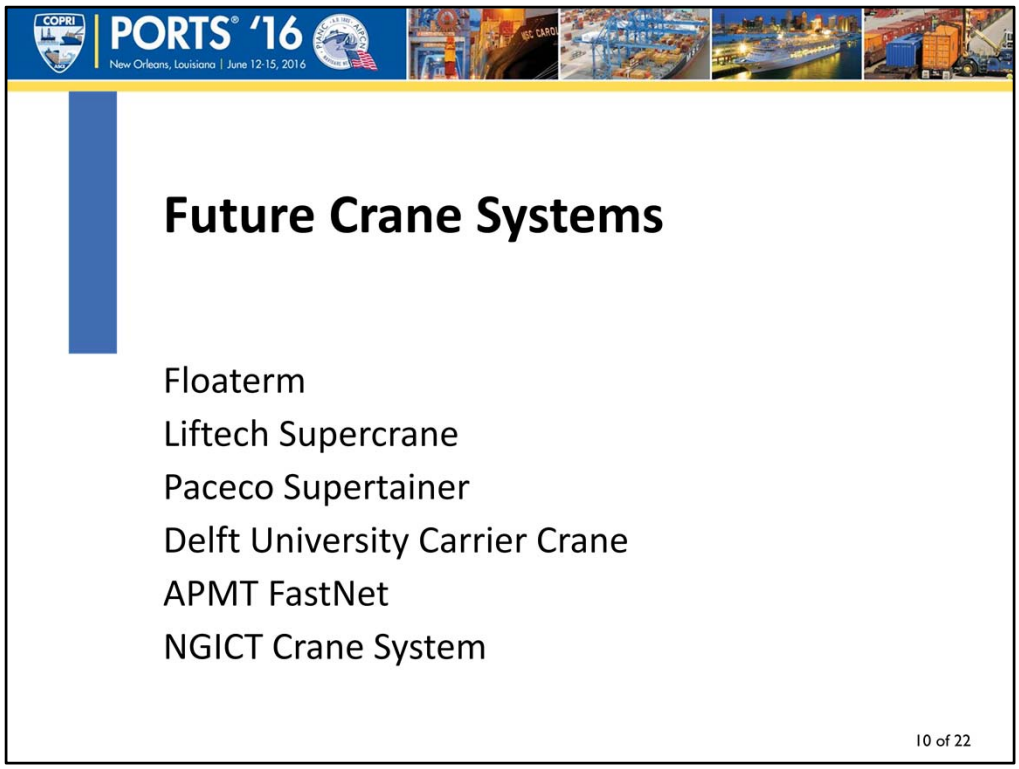
The automated region is separated from the manned region landside of the landside rail.

It has a landside platform for manned or automatic IBC (inter-box connector) removal.

A ship in a slip has only been built by Ceres in Amsterdam.

Crane access on both sides of the vessel permitted servicing adjacent vessel hatches, potentially nearly doubling the number of cranes per vessel, with a resulting reduced time at berth.

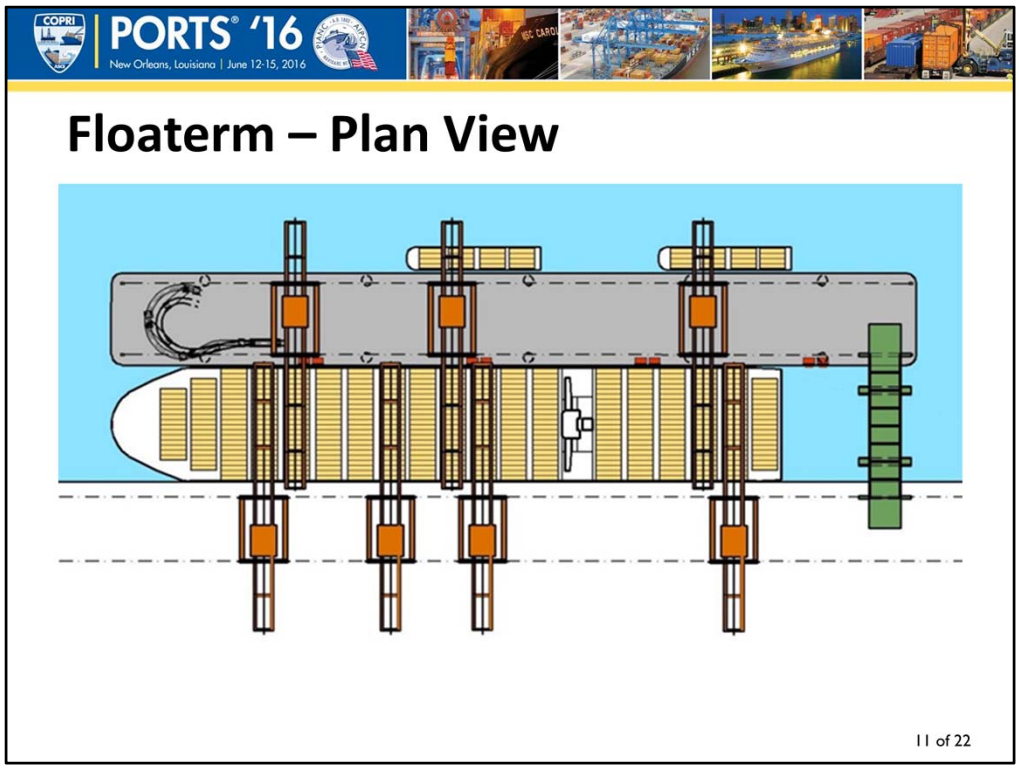
For reasons unrelated to the concept or cranes, this project was abandoned after the cranes were delivered.



Many people have developed concepts for higher productivity crane systems. This next section will review a variety of the more well known concepts.

None of these concepts have been built.

Although demand is increasing, and more detailed concepts are being developed, no one has had enough appetite for the risk involved with building one of these systems. As demands on the STS crane productivities increase, a new system will be built.



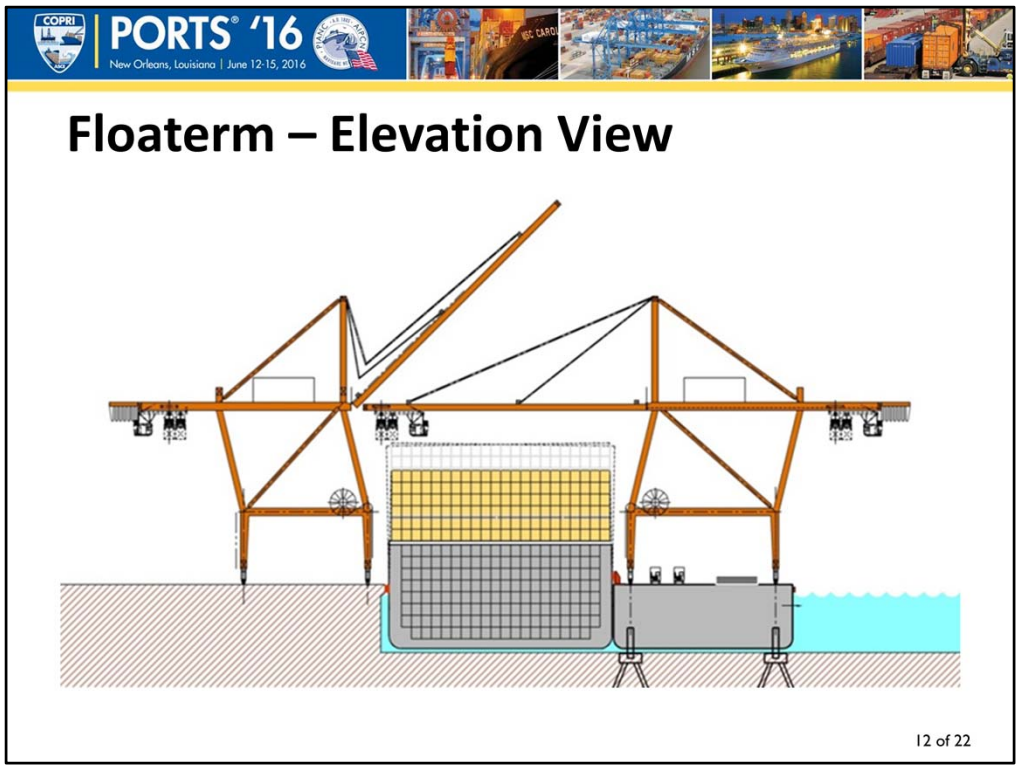
The slide shows plan view. See the next slide for elevation view.

Multiple people have considered mounting cranes on a barge so that cranes can service the ship from both sides, similar to the Ceres Amsterdam ship in a slip.

Advantages of this system include the use of conventional crane systems, flexible berth, not needing additional land, and the ability to also service feeder barges.

Another advantage is the ability to serve wider vessels in the future if needed (not easy with the Amsterdam “ship in a slip” concept).

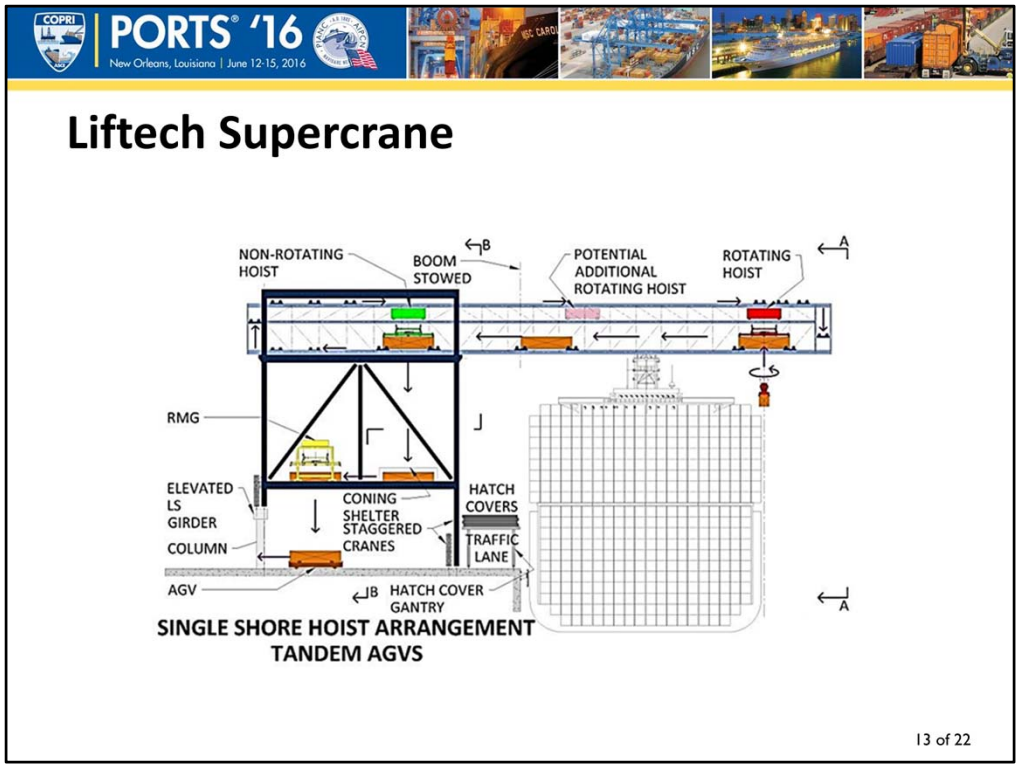
Disadvantages include needing to handle and moor the barge-crane system and its access bridge.



This concept system could also incorporate:

Connecting to the ship structure with suction systems such as the Cavotec Moormaster

Assist spuds to help anchor the barge in plan and to dampen barge movements from waves and varying operations loading on the barge



The Liftech Supercrane concept was conceived in the 1980s.

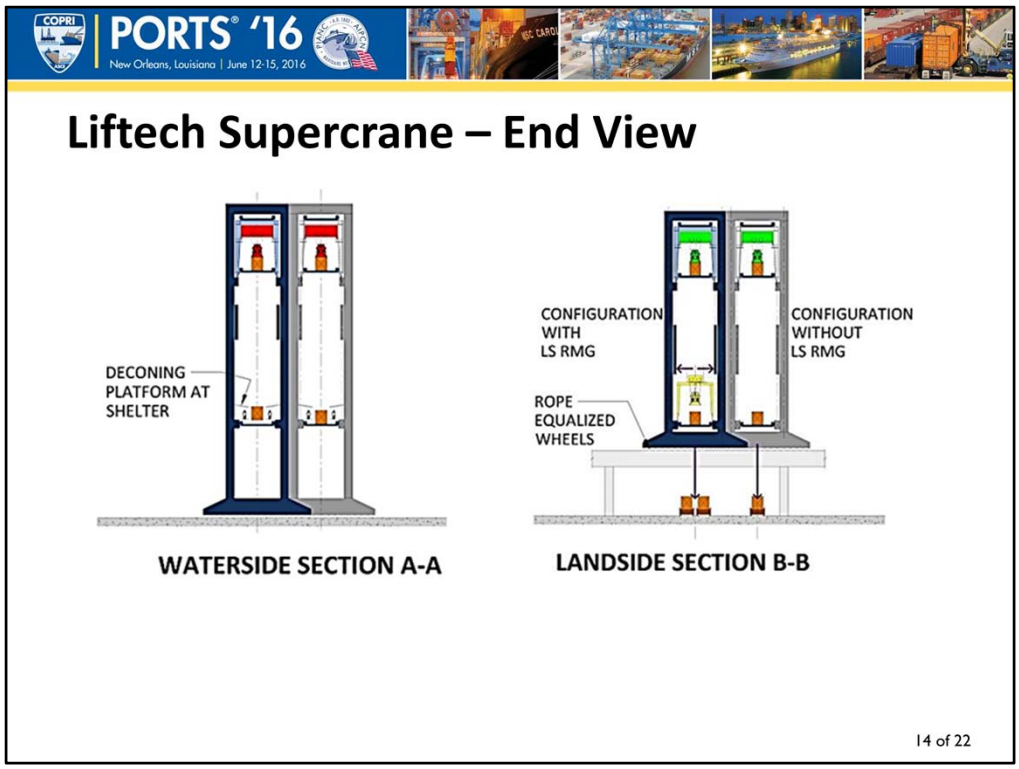
It involves rotating lifted containers so narrow cranes can be used, permitting cranes at adjacent vessel hatches. See next slide for end view.

This slide shows the container movement from the ship to the shore.

> The waterside hoist lifts and rotates the container and sets it onto carts, one on either end of the container.
> The carts move the container along rails to the landside hoist.
> The landside (non-rotating) hoist lowers the container.
> The carts continue to the landside end of the boom and a system lifts them to an upper rail that they travel along to get to the waterside end of the boom where they are lowered.

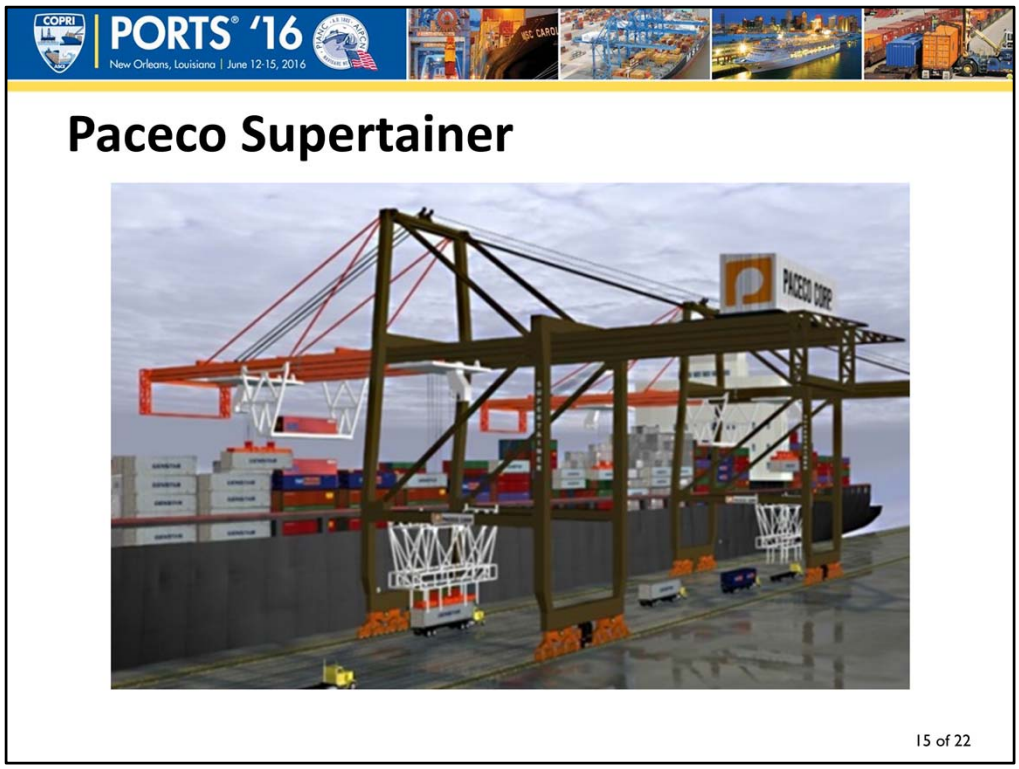
The landside RMG crane is optional.
Multiple hoists can be provided both at the landside or waterside.
Hatch covers are stored over a waterside traffic lane.

The landside has fixed columns with elevated crane rail supports for improved traffic flow.



This system has separate rails for adjacent cranes, for nesting of gantry and improved stability.

Rope reeved or elastomeric bearing equalized wheels are envisioned in the concept, but the wheel loads could be equalized with conventional cascading pinned beams.



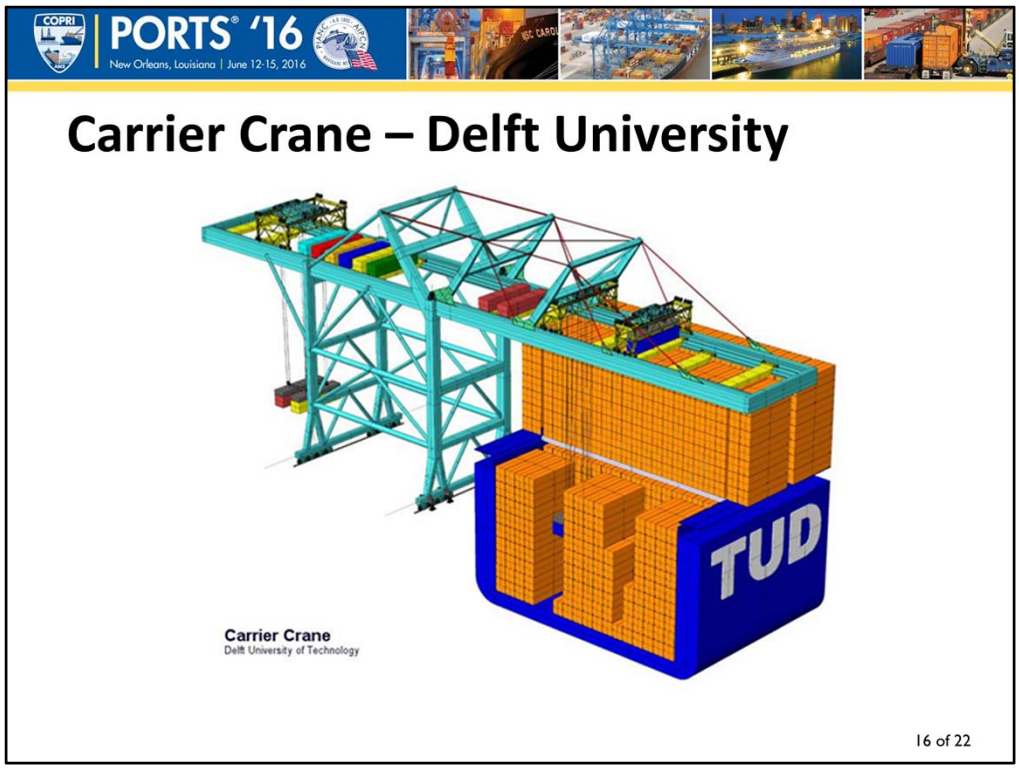
The Paceco Supertainer concept also has multiple hoists.

The waterside hoist does not travel between legs—it only hoists to the rigid horizontal traverser.

The rigid traverser carries the container between the waterside and landside hoists.

A landside hoist lowers the container to the ground chassis or AGV through a rigid guide that facilitates alignment.

Otherwise, this system is a conventional crane.



The Carrier Crane developed by Delft University includes multiple waterside hoists that lift containers onto carts which transport the containers to a landside hoist that services the yard equipment. The landside hoist handles two containers at a time.

Notice that the carts return on a lower rail, requiring lift systems at either end of the boom and coordination with the hoist systems to avoid collisions.

The APMT FastNet system is an elevated crane system for access to adjacent vessel hatches.

Fixed elevated girders are used at the landside to facilitate yard equipment access under the cranes.

Waterside girder supports are movable, permitting some flexibility in crane deployment, but also resulting in large wharf loads. Double sets of wheels are required in the foot of the movable support. Rope equalized wheel systems are used to equalize the double line of wheels and limit costs.

The cranes can pass the waterside girder support towers by raising their booms. A unique boom hinge joint permits the trolley to pass under the waterside girder.

Conventional crane machinery is used.

NGICT = New Generation Integrated Container Terminals

This system has similar advantages as FastNet with narrow cranes that can work adjacent hatches, except the crane transports containers to the waterside only.

The crane lowers the load at a waterside platform onto AGV-like transports that can move longitudinal or perpendicular to the wharf to transport the container to the desired yard stack.

Overhead cranes move containers to the yard for stacking. Stacking is also between the legs for more efficient use of space.

Hatch covers are placed at waterside.

Conclusion

Ultra large container ships need increased STS crane productivity.

A variety of recent design changes have occurred including lifting multiple 20 ft (or 40 ft) containers, increased automation, and increased use of shore hoist systems.

Concepts have been developed for potential future systems.

Some design issues have been resolved while others remain.

As demand increases, so does the probability of an unconventional system being built that dramatically improves productivity.

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Not as high-productivity… Photograph shows offloading bananas in New Orleans in 1903.

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