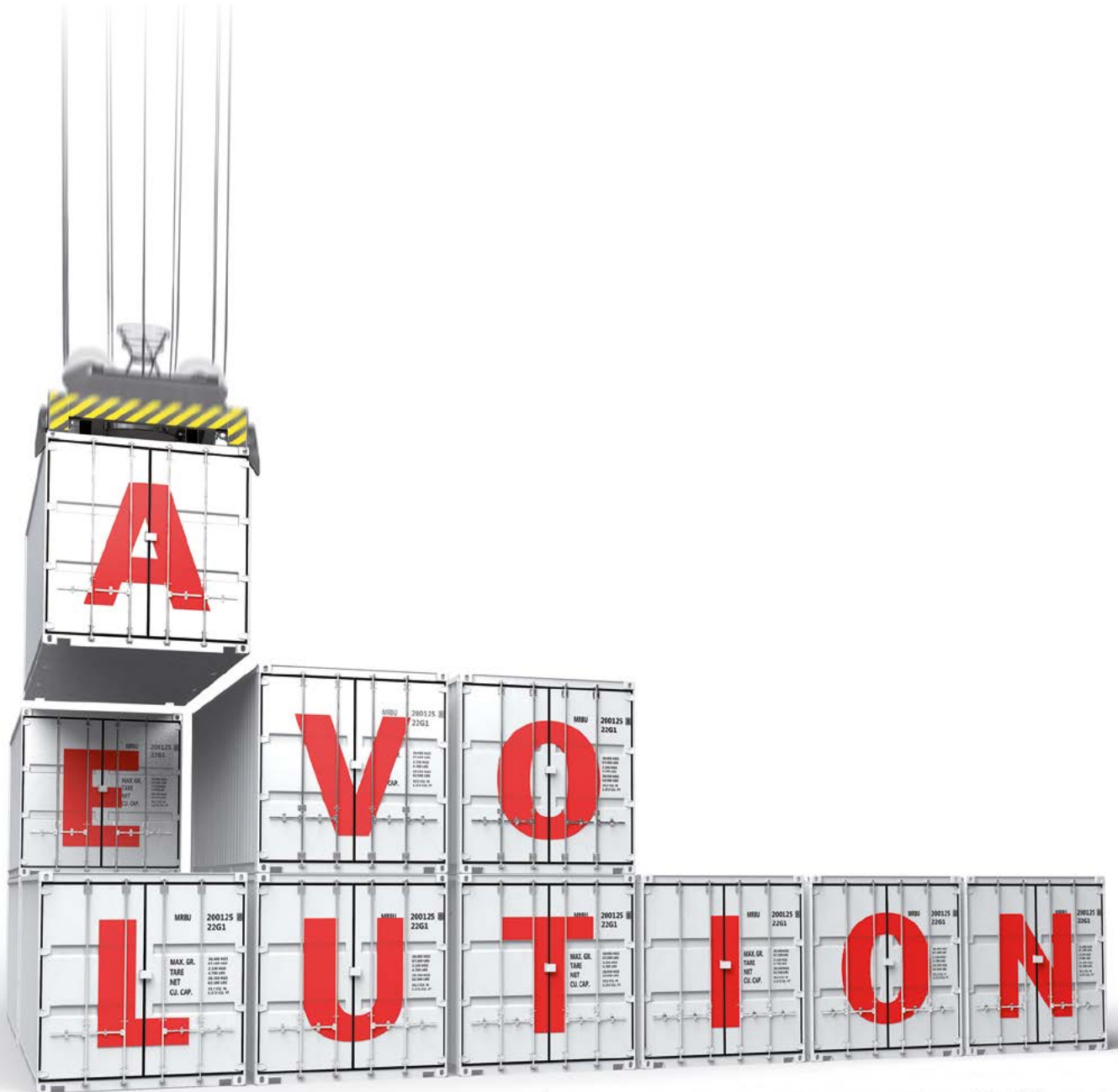


# EVOLUTION OF INTERMODAL



OF INTERMODAL

## FROM THE COMPANY WITH THE WIDEST AND DEEPEST OFFERING IN CONTAINER HANDLING

Konecranes has the widest and deepest offering in container handling. It's the widest in terms of the breadth of the product portfolio, ranging from heavy-duty lift trucks to manned container cranes to fully-automated yard crane systems. It's the deepest in terms of the manned-to-automated growth path, remote monitoring capabilities and intelligent software control. We now bring this to intermodal operators with the AVOLUTION OF INTERMODAL.

The goal of automation is to provide more predictable and reliable productivity, greater efficiency and greater safety. We offer different concepts for intermodal operations. On the rail side, they are built around the Automated BOXPORTER RMG system. On the horizontal transport side, we offer a range of options to complete the picture.



## CONCEPT 1 AUTOMATED BOXPORTER RMGs WORKING WITH A-SPRINTERS OR A-STRADS

Delivered turn-key by Konecranes

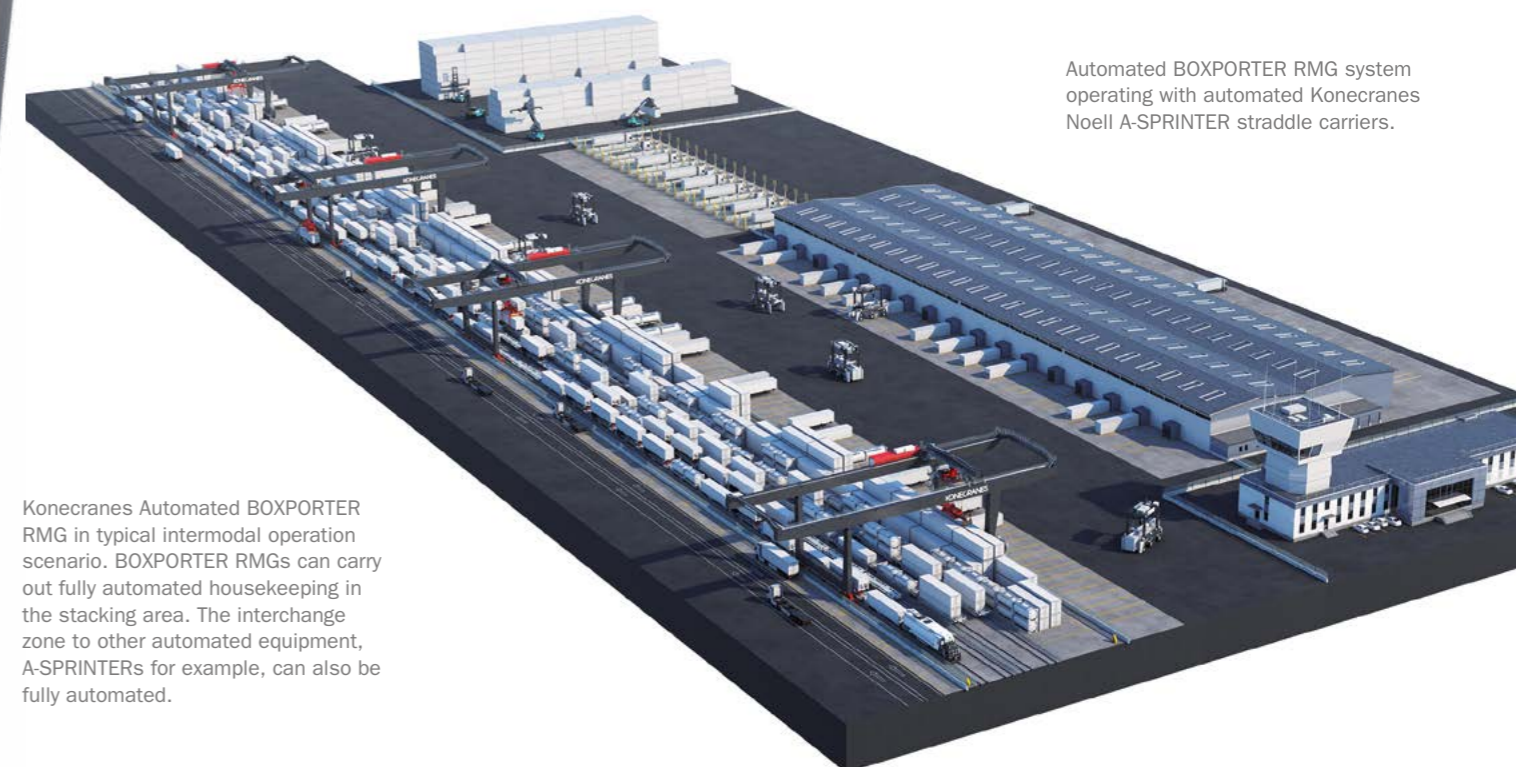
For rail handling and truck handling we recommend a semi-automated process where certain actions are supervised or remote-controlled by human operators at Remote Operating Stations.

For horizontal transport, Konecranes Noell A-SPRINTERS can be an excellent choice. The combination of A-BOXPORTER RMGs with A-SPRINTERS offers many advantages:

- Fast horizontal transport alongside the rail that is independent of crane movement. During rail-to-rail interchange, containers can be transported from one end of the train to the other without occupying the cranes. Pre-sorting of containers alongside the train can also be achieved.
- The A-SPRINTERS can load and unload road trucks in dedicated transfer areas.

- An automated connection to other facilities, such as warehouses, can be made with A-SPRINTERS.

This concept is a good choice for medium-to-large intermodal terminals with interchange between trains, road trucks and warehouses.



Automated BOXPORTER RMG system operating with automated Konecranes Noell A-SPRINTER straddle carriers.

Konecranes Automated BOXPORTER RMG in typical intermodal operation scenario. BOXPORTER RMGs can carry out fully automated housekeeping in the stacking area. The interchange zone to other automated equipment, A-SPRINTERS for example, can also be fully automated.

## CONCEPT 2 AUTOMATED BOXPORTER RMGs WORKING WITH ARMGs AND LIFT-AGVs

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**If an automated rail terminal needs to be integrated with a deep-sea container terminal using ARMGs, a concept using Konecranes Gottwald Lift-AGVs for horizontal transport would be a good solution.**

The Lift-AGVs automatically connect the rail terminal with the ARMGs in the stacking area of the deep-sea container terminal. Lift-AGVs are a good choice for transport between two crane systems, because they are very agile and energy-efficient vehicles with fully electric battery drives.

For a decoupled operation, racks can be used for placing and picking up containers. In this case, the racks can also be used for buffering and pre-sorting containers for outgoing trains.

Of course, automated horizontal transport between the ARMGs and the STS cranes can be also be successfully achieved with Lift-AGVs.

This concept is suitable for deep-sea terminals with a direct connection to a railway, that are seeking a high degree of automation.



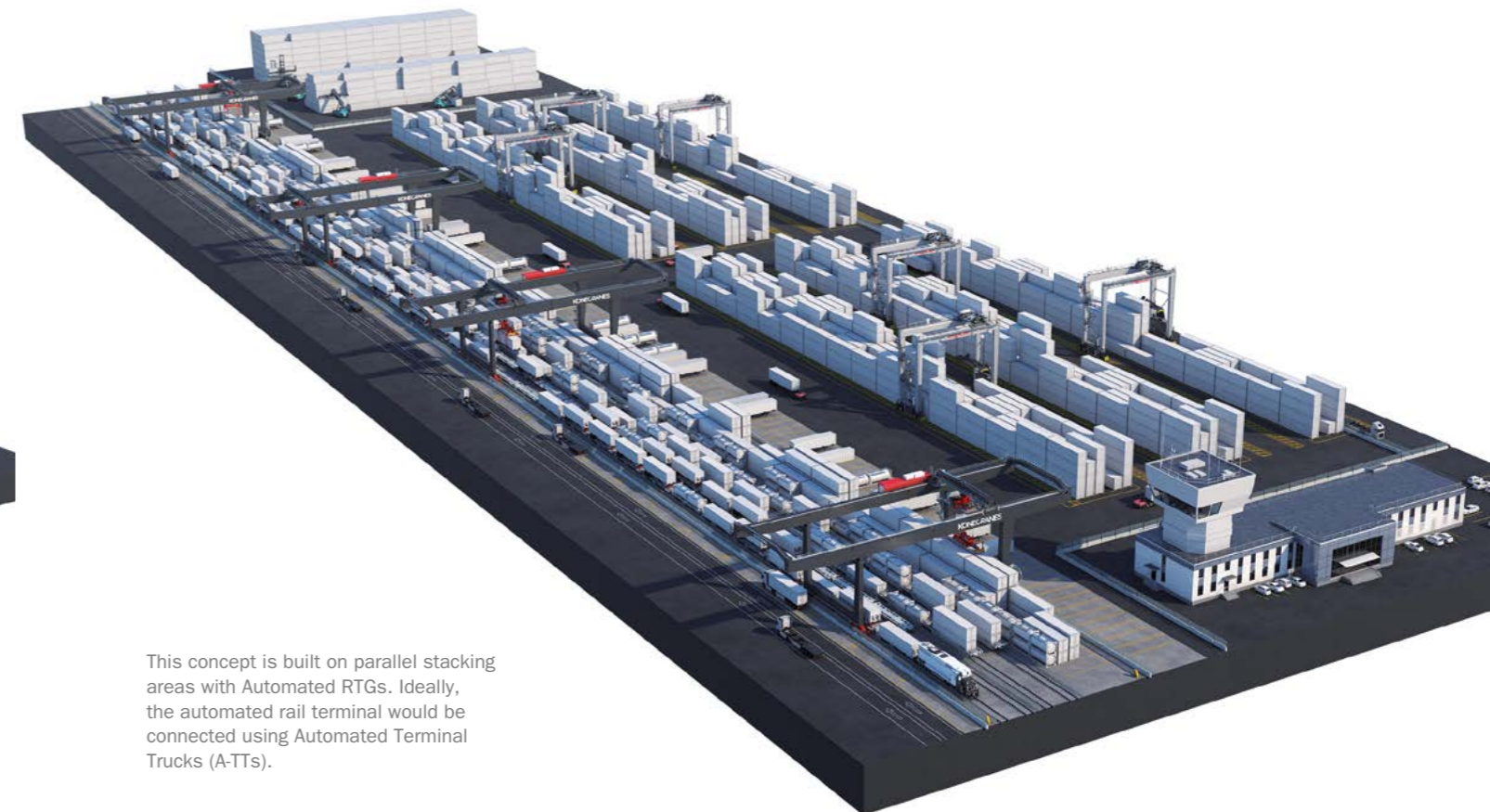
## CONCEPT 3 AUTOMATED BOXPORTER RMGs WORKING WITH ARTGs AND A-TTs

Delivered turn-key by Konecranes

**The A-BOXPORTER RMGs perform semi-automated handling of trains and road trucks. Next to the railway, the containers are placed on trailers which are then transported to the stacking area by Automated Terminal Tractors (A-TTs). The trailers are also used to buffer and pre-sort containers for outgoing trains.**

For the stacking area, Konecranes ARTGs are a proven solution for automated stack handling. We can implement a fully automated interchange with A-TTs, so the horizontal transport and housekeeping are completely automated.

Here we recommend implementing remotely-supervised handling of road trucks on separate land-side lanes that are disconnected from the main automated area. This concept is suitable for deep sea terminals using parallel RTG stacks that are seeking a high degree of automation.



This concept is built on parallel stacking areas with Automated RTGs. Ideally, the automated rail terminal would be connected using Automated Terminal Trucks (A-TTs).

## CONCEPT 4 AUTOMATED BOXPORTER RMGs WORKING WITH AGVs

Delivered turn-key by Konecranes

**This concept is an excellent choice for automating typical rail-hub terminals that need to focus on fast and efficient interchange between different trains.**

AGVs are used as a horizontal transporting system for pre-sorting containers and performing long-distance transportation alongside the railway. The A-BOXPORTER RMGs can be focused on train loading and unloading, giving a very productive operation. The terminal can be built up in a very eco-efficient manner, since the AGVs can be fully-electric.



## NOT JUST SAFE MACHINES, BUT A SAFE SYSTEM


**The Konecranes approach to safely automating container handling in intermodal is to carefully analyze, together with you, all areas of interaction between human beings and machines in the operating environment. In intermodal, there are two “territories” to distinguish in this respect:**

- 1) The territory used by the automated horizontal transport machines, which can be A-STRADS, A-SPRINTERS, Lift-AGVs, A-TTs, or combinations thereof. Here, Konecranes has more experience than any other company, with many successful implementations and an excellent safety record.
- 2) The territory used by the Automated RMGs, consisting of rail tracks and truck lanes. Here, human beings must manually travel along the rails to lock and unlock containers and manage the trains as a normal part of the operation. Here we recommend remote operation of the ARMG cranes from Remote Operating Stations, to ensure safe interaction between humans and machines.

Independently of what your system will look like, Konecranes can deliver a turn-key solution that includes all of the required safety functions in the machines and the control systems. The machines will be safe. Their interaction with other system components will be safe. The entire intermodal operation will be safe.



Konecranes is a world-leading group of Lifting Businesses™, serving a broad range of customers, including manufacturing and process industries, shipyards, ports and terminals. Konecranes provides productivity enhancing lifting solutions as well as services for lifting equipment of all makes. In 2017, Group sales totaled EUR 3,136 million. The Group has 16,200 employees at 600 locations in 50 countries. Konecranes shares are listed on the Nasdaq Helsinki (symbol: KCR).

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