

FROM THE INVENTOR OF STRADDLE CARRIERS FOR CONTAINER HANDLING

# A-STRAD: FOR BROWN, GREEN AND FUTURE FIELDS



## THE NEXT STEP IN CONTAINER TERMINAL AUTOMATION

# A-STRAD AND A-SPRINTER

**Automation is the answer to one of the major challenges faced by container terminals today: how to handle the steadily growing number of containers transported on ever larger vessels in an eco-efficient manner. Konecranes has always been a pacesetter in this area and has established reliable complete solutions with AGVs, ARMGs and, most recently, ARTGs. Konecranes now offers automated straddle carrier and sprinter carrier systems.**

### KONECRANES PORTFOLIO AND PHILOSOPHY

Konecranes has the broadest and deepest portfolio along the process chain in container handling. It is also the leader in automated container handling in ports and terminals, offering complete solutions for the container stackyard and horizontal container transport. These include all of the needed sub-systems and software, such as the Navimatic® navigation system and the TEAMS fleet management system, as well as consulting and service.

With the launch of the automated Konecranes Noell Straddle Carrier (A-STRAD) and Sprinter Carrier (A-SPRINTER), we are starting a new chapter in container transport and storage. For container terminals using straddle carriers, investing in A-STRAD is the way to make terminals fit for the future with Konecranes, the leader in container terminal automation.

Konecranes is introducing A-STRAD based on the consistent application of an integrated development approach that includes detailed feasibility studies and testing. The result is a cost-effective, well-engineered, tried-and-tested system based on:

- Automated machines built on a long track record of manually operated machines
- All the needed sub-systems and software

With Konecranes, straddle carrier operators can realize a sustainable competitive advantage from the start.

We have systematically tested A-STRAD in fully automated live operation, in stacking heights of up to 1-over-3, at our testing ground near our straddle carrier competence center in Würzburg, Germany.

## STRADDLE CARRIER AUTOMATION

# CHALLENGE MASTERED

**The automation of straddle carriers presents some specific challenges for the supplier of integrated systems. The straddle carrier not only combines the two functions of “horizontal transport” and “storage” in one machine. Its basic design with a high center of gravity (compared to AGVs, for example) and relatively low rigidity (versus ARTGs or ARMGs, for example) also requires special expertise in order to achieve successful automation.**

In the case of brownfield container terminals, converting to automated operation also may entail parallel operation of manual and automated machines, giving special requirements with regard to interfaces and safety.

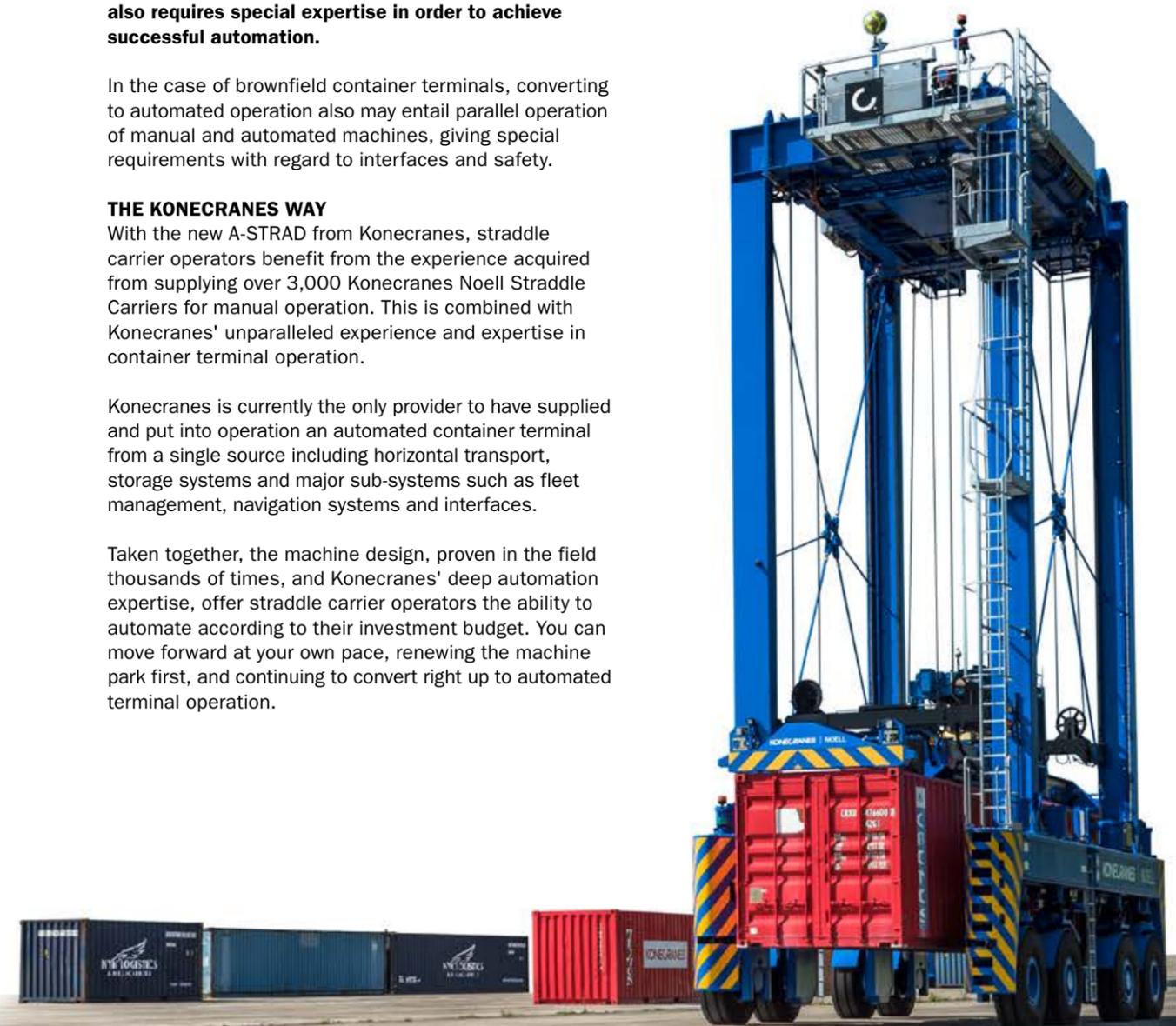
### THE KONECRANES WAY

With the new A-STRAD from Konecranes, straddle carrier operators benefit from the experience acquired from supplying over 3,000 Konecranes Noell Straddle Carriers for manual operation. This is combined with Konecranes' unparalleled experience and expertise in container terminal operation.

Konecranes is currently the only provider to have supplied and put into operation an automated container terminal from a single source including horizontal transport, storage systems and major sub-systems such as fleet management, navigation systems and interfaces.

Taken together, the machine design, proven in the field thousands of times, and Konecranes' deep automation expertise, offer straddle carrier operators the ability to automate according to their investment budget. You can move forward at your own pace, renewing the machine park first, and continuing to convert right up to automated terminal operation.

To safeguard such a major investment decision, Konecranes offers tools for simulation and emulation. These are put to work before the first cut of the spade, giving you the most accurate picture possible of your terminal processes and the handling capacities to be expected.



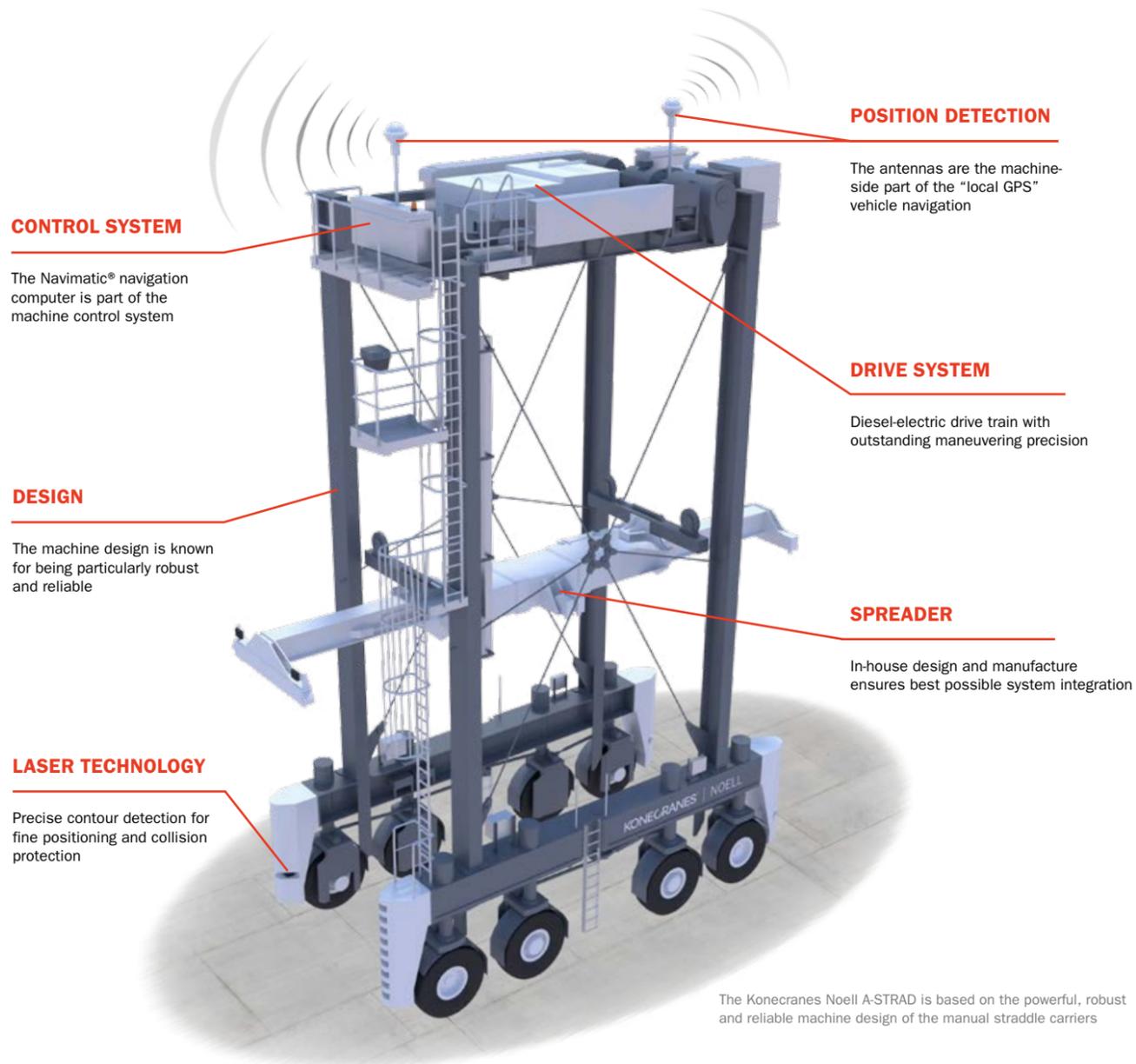
## WINNING DESIGN

## THE MACHINE

**Konecranes Noell A-STRADs are based on the winning machine design of the manual straddle carriers, known for being particularly powerful, robust and reliable.**

They feature the market-leading diesel-electric drive system whose outstanding maneuvering precision, also in automated operation, makes the crucial difference when it comes to navigation and positioning.

This foundation is supplemented by automation-specific control and sensor systems. Here, the intelligent use of laser technology for precise contour detection provides fine positioning and collision protection in the container stackyard. Another plus, which is also a positive factor for automation, is that the A-STRAD and its spreader come from the same developer and manufacturer. This ensures the best possible mechanical and control-related integration for precise container handling and safe operation.



## OPERATED SUCCESSFULLY BY LEADING CONTAINER TERMINALS

## SUB-SYSTEMS AND SOFTWARE

**Konecranes draws upon acknowledged leading technology that is constantly being developed further, not only for the straddle carriers themselves but also for sub-systems such as the interchange and fence control systems and software.**

An example is the Navimatic® navigation system, which was developed in-house and is currently being used to reliably operate several hundred Konecranes Gottwald Automated Guided Vehicles.

Depending on specific requirements, Konecranes uses various systems for vehicle navigation, i.e. position detection:

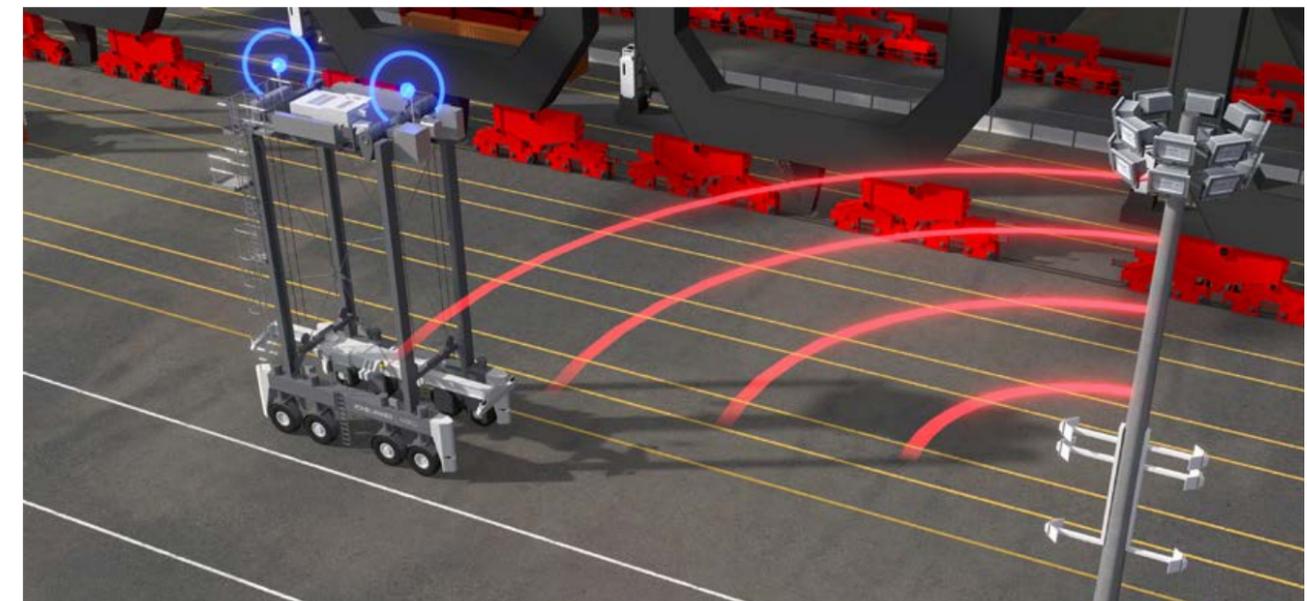
- The so-called local GPS is a terrestrial system based on GPS principles to achieve outstanding navigation precision. The network consists of transmitter radio masts with corresponding antennas and receivers on the A-STRADs themselves.
- The transponder system is based on a grid of passive transponders (electromagnetic route markers) embedded in the terminal ground as well as a surface antenna (sender/receiver unit) mounted close to the ground on the equipment side.

The TEAMS fleet management system is used by several leading automated terminals to operate AGV fleets, automated stacking cranes and ship-to-shore cranes, and has now been enhanced to meet the requirements of straddle carrier systems.



The transponder system, familiar from the Konecranes Gottwald AGV, is based on passive transponders in the terminal ground and surface antennas on the equipment side

The "local GPS" consists of radio transmitter masts in the terminal with corresponding antennas and radio receivers on the machines.



## CONVERSION OF MANUAL CONTAINER TERMINALS

# BROWNFIELD

**Many existing straddle carrier terminals operate with completely different layouts and configurations.**

These currently include:

- Homogenous fleets with either 1-over-2 or 1-over-3 machines
- Mixed fleets with 1-over-2 and 1-over-3 machines.

With Konecranes, terminal operators have a choice between introducing automation in one large step, or introducing it gradually. An alternative is to move first to semi-automation in order to benefit from automation in terms of:

- Improved and more predictable productivity
- Reduced labor and operating costs
- Improved eco-efficiency
- Improved safety,

thus staying competitive far into the future.

Any conversion from manual to automated terminal operation must be carefully planned, since terminal operation should continue during the conversion phase.

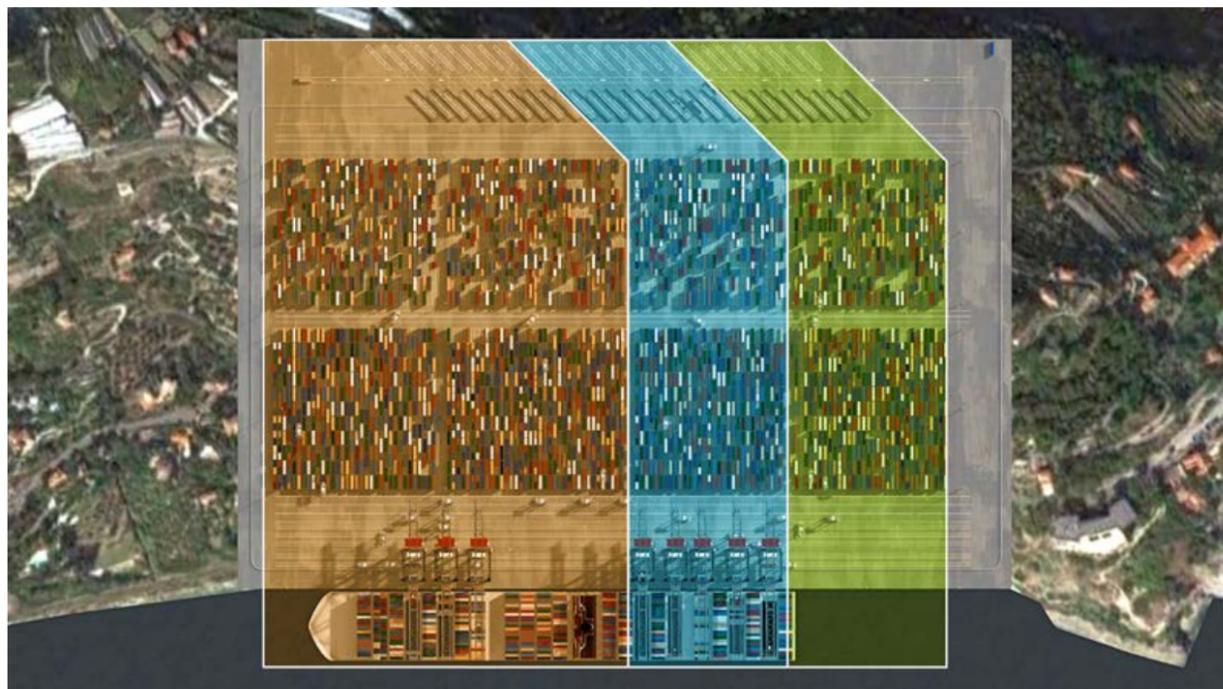
Conversion normally takes place in stages. Individual terminal sections consisting of several ship-to-shore cranes, horizontal transport zone, assigned storage area and landside connection to road truck or train loading are successively closed off and converted to automated operation, while the other sections remain operational. A conversion by function is also possible, where horizontal transport and storage are converted in succession.

In this case, “local GPS” is the preferred system for navigation since it enables gapless locating of the machines and it can be easily integrated into an existing terminal.

### AUTOMATION-READY CONTROL SYSTEM

In addition to the option of acquiring completely new A-STRAD machines equipped with the automation technology from the outset, conversion is simplified by the design of the control system of existing diesel-electric straddle carriers from Konecranes, which have built-in readiness for automation. Specific automation components, such as navigation antennas and positioning sensors, can be retrofitted easily.

Brownfield terminal conversion normally takes place in sections



## NEW CONTAINER TERMINALS

# GREENFIELD



The Konecranes Noell A-SPRINTER appeals to developers of greenfield terminals

**Konecranes is also introducing the Konecranes Noell A-SPRINTER for automated horizontal transport at container terminals.**

This is a 1-over-1 machine specializing in horizontal transport that appeals to developers of greenfield terminals.

With the diesel-electric A-SPRINTER, Konecranes is extending its range of automated container horizontal transport options and placing this machine alongside the tried-and-tested AGV. Here Konecranes is taking into account a wide range of individual terminal strategies.

On the machine side, the A-SPRINTER is also based on its manual counterpart and thus benefits from the same advantages as the Konecranes Noell A-STRAD.

In addition to the “local GPS” described previously, the familiar transponder solution from the AGV lends itself well to A-SPRINTER navigation because the terminal will be re-equipped and does not have to be cleared first to embed the transformers.

## THE FUTURE FIELD CHOICE

With the new A-STRAD and A-SPRINTER, Konecranes offers automated straddle carrier technology, built on field-proven modules, that adapts to the container terminal requirements of today and tomorrow.

Whether pure horizontal transport with the A-SPRINTER or transport and storage with the A-STRAD, whether the terminal is brownfield or greenfield, if you are a straddle carrier operator searching for automation, you will find what you need in our complete range including associated hardware and software.

Konecranes is leading the way in container terminal automation.



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 2016, Group (comparable combined company) sales totaled EUR 3,278 million. The Group has 17,000 employees at 600 locations in 50 countries. Konecranes class A shares are listed on the Nasdaq Helsinki (symbol: KCR).

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