UNMANNED CONTAINER HANDLING
MEETING THE FUTURE CHALLENGES
When to Automate

Main Reasons
In market areas with high labor costs, labor accounts for more than 50% of overall costs in a terminal. Therefore automation can result into significant savings in overall costs and improved profitability.

In some market areas where availability of a qualified labor force may be problematic, automation can help to avoid this. Automation also makes it possible to operate 24 hrs / 7 days at very low or no incremental costs.

Where to Focus
It is important to identify the areas that are most suitable for automation and give the biggest benefits. Automatic stacking cranes are easy to automate and are already widely used in container handling. When combined with Shuttle Carriers®, they give high vessel productivity and high storage capacity at very low labor costs.

Another attractive and cost effective alternative is the AutoStrad automated straddle carrier operation, with even higher operational flexibility. This should be specifically attractive to existing straddle carrier terminals, as in many cases automation can also be applied to existing straddle carriers.

Automatic stacking cranes can also gradually be introduced to an existing straddle carrier operation, in order to further increase storage capacity.

Benefits of Automation
The benefits of automation are not only limited to the direct operator labor costs or availability of qualified operators.

By introducing automation, it is usually possible to reduce overall operating costs and increase the utilization rate of equipment. Automation can also eliminate accident damage and in some cases reduce infrastructure costs, such as required pavement and lighting.

The level of jobs available in an automated terminal is typically more demanding than in a manual terminal. Automation will also result in increased safety and security in the terminal because of limited access to people.
How Kalmar Can Help You

System Knowledge
Kalmar can help individual terminals analyze how automation could be applied to its specific conditions and evaluate the benefits and cost savings.

Kalmar, together with its partners, can deliver automated handling systems; not only equipment, but also the design expertise and operating software required in such projects.

Long Experience
Kalmar has an impressive history in terminal automation. It has introduced several new concepts, such as a second trolley in ship-to-shore cranes, industrial straddle carrier automation based on transponders, automatic stacking cranes and Shuttle Carriers®. Smartrail®, a DGPS based automatic steering and container positioning system for RTG cranes, has been a great success. The first automated straddle carrier terminal is in operation in Brisbane, Australia using Kalmar equipment.

Main Steps to Automation
- Select a handling system that can be automated
- Make sure your layout is designed so that automation will be possible
- Make a study including a cost impact analysis before starting
AutoStrad Straddle Carrier Automation

Main Data

- Straddle carriers used for all functions: stacking, transportation and loading and unloading of road trucks.
- Estimate 4-5 straddle carriers required in total per ship-to-shore crane, including landside operation (actual needs to be evaluated case by case)
- Storage capacity approx. 500 TEU per hectare 2-high (3-high SC) and up to 750 TEU per hectare 3-high (4-high SC)
- Low labor usage
- Remote control used for loading and unloading of road trucks.

- Optimum solution for medium to large size operations, when high flexibility and selectivity are required and labor usage needs to be minimized
Vessel Side Operation
The work cycle is similar to a manual straddle carrier operation. Straddle carriers leave and pick up containers directly from the ground under the ship-to-shore crane, thus creating a buffer under the crane. This unique concept will maximize ship-to-shore crane productivity and reduce overall amount of equipment required. Straddle carriers transport containers between the vessel side and stacking area.

A manual area is needed for the handling of semi-automatic twistlocks, hatch covers and oversized containers. The manual area is normally located under the ship-to-shore crane portal and the automated operation under the ship-to-shore crane backreach. The automated and manual areas are separated by a fence.

Yard and Landside Operation
Similar narrow aisles are required between the container rows, as in a manual operation.

Container rows can be longer than in a manual operation, as steering is done automatically. Straddle carriers transport and stack containers within the stacking area.

Loading and unloading of road trucks is done by straddle carriers via remote control, with one operator controlling several loading and unloading positions.

Loading and unloading of railcars is normally done manually by reach stackers in smaller terminals and by RTG or RMG cranes in larger terminals.

Automation
The straddle carrier fleet is controlled by a Traffic Management System. Navigation is mainly based on radar, GPS and an Inertia Navigation System. A fine positioning system (Automatic Pick and Place) based on sensors is used when approaching the container. An additional laser system is used for collision avoidance.
Automatic Stacking Cranes and Shuttle Carriers®

Main Data

- Estimate 4 automatic stacking cranes required in total per ship-to-shore crane, including landside operation (actual needs to be evaluated case by case)
- Estimate 2 Shuttle Carriers® required on vessel side per ship-to-shore crane
- Storage capacity of 1 000 – 1 200 TEU per hectare
- Low labor usage
- Low operating and maintenance costs
- Automatic stacking cranes are fully automated, except loading and unloading of road trucks via remote control
- Shuttle Carriers® can be manual or automated

- Optimum solution for large and very large terminals, when high storage capacity is required and labor usage needs to be minimized
Vessel Side Operation
Shuttle Carriers® leave and pick up containers directly from the ground under the ship-to-shore crane, thus creating a buffer under the crane. Shuttle Carriers® also transport containers between the vessel side and stacking area. In the same way, Shuttle Carriers® leave and pick up containers from a buffer area in front of the automatic stacking crane stacks. This buffer can be several slots deep.

This unique concept decouples vessel and yard operations, thus maximizing both ship-to-shore and yard crane productivity. This also results in a fewer vehicles required (50% compared to AGV operation), due to minimal waiting times. Fewer vehicles also means that higher traffic volumes can be handled without traffic congestion, making it possible to operate with higher vessel productivity with multiple ship-to-shore cranes and also with tandem lift cranes.

A manual Shuttle Carrier® operation normally takes place under the ship-to-shore crane portal, with hatchcovers stored under the backreach. In an automated Shuttle Carrier® operation, a manual area is needed for the handling of semi-automatic twistlocks, hatchcovers and oversized containers. The manual area is normally located under the ship-to-shore crane portal and the automated operation under the ship-to-shore crane backreach. The automated and manual areas are separated by a fence.

Yard and Landside Operation
Automatic stacking cranes are used for block stacking and in-stack transportation. Automatic stacking cranes leave and pick up containers from the buffer area in the front end of the stacks. The automatic stacking crane stacks are located at a 90 deg angle to the quayside, in order to minimize Shuttle Carrier® travelling distances.

Loading and unloading of road trucks is done in the rear end of each stack. This is done directly by automatic stacking cranes via remote control, with one operator controlling several cranes. Shuttle Carriers® can be used for transporting containers between the stacking area and the rail operation and also for loading and unloading of road trucks, if necessary. Loading and unloading of railcars is normally done manually by reach stackers in smaller terminals and by RTG or RMG cranes in larger terminals.

Automation
The automatic stacking cranes are controlled by a Traffic Management System (TMS), which communicates with the Terminal Operating System (TOS). The TOS includes all information about container positions and required movements, whereas the TMS calculates yard crane routes and speeds and avoids collisions. Positioning of the yard crane is done with absolute sensors, while laser and camera systems are used for landing and picking up containers in the stack and buffer areas.
Kalmar Industries

Lifetime Business Partner
Kalmar is a global provider of container and heavy duty materials handling equipment, automation applications and related services. It is the world’s leading supplier of cargo handling equipment to ports, terminals and intermodal facilities. Every fourth container or trailer transfer at terminals around the world is handled by a Kalmar machine.

Global Operation
Production plants are situated in Sweden, Finland, the Netherlands, Malaysia, China and the USA. The Kalmar network equates to 19 sales companies and over 300 dealer locations around the world. Today, more than 80,000 Kalmar machines are in operation in environments ranging from sub-zero arctic climates to tropical humidity and heat. Our global experience and understanding of local conditions enable us to serve customers in all corners of the world.

Services for Full Response
Kalmar’s product range is complemented by a large range of value added services such as maintenance contracts and fleet management. As customers seek to focus more on their core business, Kalmar offers the flexibility of switching from ownership to leasing or pay per performance. Kalmar is also leading the way in port automation with its application of unmanned container handling technology, on-board smart features and remote maintenance products, developed in co-operation with customers and partners.

Kalmar Industries Oy Ab
P.O. Box 387, FI-33101 Tampere, Finland
Tel. +358 3 265 8111, Fax +358 3 265 8201
www.kalmarind.com