Kalmar
Automated terminals
Why automation?
What is possible today
Types of automated terminals

- Automated straddle carrier terminal
- Automated RTG terminal
- Automatic stacking crane terminal
- Hybrid terminal

Automatic Stacking Crane  AutoStrad  AutoShuttle  AutoRTG
AHTS with AutoShuttles
Fully decoupled container handoffs under STS and ASC ensures best STS productivity with highest utilization of the equipment.

STS operation
- Remote controlled STS with semi-automated functions
- Automated twistlock handling using ALP
- OCR for container ID recognition
- Exclusion between STS and Autoshuttles

ASC stacks
- 2 crane ASC blocks
- Access Control System that ensures safety of the personnel
- Own inventory database

Landside operation
- Automated truck handling using Kalmar ATH
- Remote control needed only for exception handling

Gate operation
- OCR for container ID recognition
- RFID identification and/or LPR

Example of Kalmar total automation solution
Influences of the setup of a terminal

- Parallel vs. perpendicular
- Transhipment or import / export operation
- Design capacity in TEU
- Area available
- Performance
- OPEX & CAPEX

Lay-out / proposed solution
Kalmar References
ECT Delta Terminal, Rotterdam

- First fully automated container terminal in the world.
  - a combination of an automatic stacking crane yard and automated guided vehicles (AGVs) on the waterside
  - manned straddle carriers feed containers from the ASC yards to road trucks on the landside
- 105 Kalmar ASCs in operation.
- 11 Kalmar 1 over 5 high automatic stacking cranes to replace old 2 high cranes to increase stacking density
- Concept: one crane per block supported by a rescue crane

- Performance level 25-30 cont/hr/STS
- Inhouse developed software
- Stack orientation: perpendicular
- 4 AGV (Gottwald) per STS
- Coupled process
- Handover AGV-STS between the legs with fixed lanes
- 1 ASC (Kalmar/ZPMC) per block
  - 1-0-3 and 1-0-4
  - 6 wide
  - Replacement 11 units 1-0-5
HHLA CTB Hamburg- Germany

- 3 ASC cranes per block
  - Operational since 2010

- Combination of automated stack and manned shuttles for horizontal transport

- 8 “blocks” of each 3 ASC cranes & Automation:
  - Control & automation systems
  - Monitoring systems
  - Remote control systems
  - Navis: Sparcs for Planning, HPC/Inform for scheduling and execution

- Plan 22 blocks, totalling 90 cranes
DPW London Gateway - UK

- Capacity 3.5M TEU
- Kalmar: 40 Automated Stacking Cranes + 20 ASC ordered and 28 Manned Shuttles (prepared for automation) for horizontal transport
  - Operational: 2014
  - Prepared for full automation
  - Designed for 35 cont/hr/quay (ZPMC)
  - De-coupled process
  - Software: Navis N4 and Kalmar TLS
  - 2 ASC (Kalmar) per block
    - 1-0-5
    - 10 wide
  - Landside: Kalmar automated truck handling

“It is of utmost importance for us to have equipment and a terminal operating system that are fully integrated and make our operations as efficient as possible.”

Andrew Bowen, Engineering Director, DP World London Gateway
DP World, Brisbane

- Capacity 900,000 TEU
- 14 Kalmar ASCs and 14 manned Kalmar shuttle carriers
- Kalmar automated truck handling automates the landside operations
- Navis N4 TOS, Kalmar TLS

"Ultimately, we felt that a combination of ASCs and shuttle carriers would not only provide the best financial return on investment, but also the highest level of waterside productivity."

Mark Hulme, Director & General Manager
DP World Brisbane
VICTL Melbourne (ICTSI)

- Total planned capacity 1.4M TEU consisting of
  - 6 STS with 21 AutoShuttles and 28 ASCs
- Phase 1: 12 Kalmar ASCs and 11 Kalmar AutoShuttles
- Kalmar automated truck handling automates the landside operations
- Integrated Kalmar TLS and Navis N4 TOS with integration services
- Opening 1 January 2017
Automated straddle carrier terminal
• Open since 2007
• Quay length 930 m
• Capacity 800 000 TEU
• 27 Kalmar AutoStrads™ – 3-high
• Twinlift operation
• Decoupled process
• STS productivity +/- 30 cont/hr
• 2+ transfer lanes on backreach – 4 highways
• 3 highways
• 26 truck grids
• From RTG and terminal tractors → ASCs and AutoStrads
• A combination of perpendicular, parallel and SC-stack
• Terminal concept: Kalmar ASCs and AutoStrads™ for horizontal transport
• Operational: 2014
• Designed for 30-35 cont/hr/quay crane
• De-coupled process
• 3 AutoStrads per quay crane
• Software: In-house TOS and Kalmar TLS
• Landside: Kalmar Automated truck handling
Kalmar Automated terminal design with autoshuttle®
- High throughput
- ASC allow for high stacking density
- AutoShuttles decouple machine work cycles to ensure optimum efficiency
- Low labour usage
- Constantly high, predictable and reliable performance 24/7
- Secured operational environment
- Environmentally friendly, all electrical stacking
- Reduces overall operating costs
- Long lifetime 25 years / 4,000,000 operation cycles
ASC- waterside module

Waterside interchange area

- ASC operations in transfer lanes are fully automated
- Typically 4 (9 wide ASC) or 5 (10 wide ASC)
- Independent lanes per block, No overlap between adjacent lanes
- WS-ASC parking positions
- Maintenance area concept (at the end of rails)
ASC - landside module

Landside interchange area

- Solution for **fully automated ATH** and semi-automated road truck handling available
  - Optimized productivity
  - Uncompromised safety
  - Reduced operational cost

- Automated chassis handling for terminal tractor trailers

- Multiple transport system support in one transfer area

- Maintenance area concept
AutoRTG – step by step approach
Benefits of Shuttle Carrier as horizontal transport

- **Layout:**
  - Less space needed on the Apron compared to AGV concept
  - Efficient use of available space
  - In RTG layout no need for separate by pass lanes

- **Operations**
  - Extra Buffer capacity
  - Backreach handling in combination with flexible lanes
  - Decoupled operation
    - Less equipment – less congestions
  - Safety
    - Container handling equipment and external trucks separated
  - In RTG design higher utilization of storage capacity
  - Easy to automate
Auto RTG - Quay Operation (AutoSHC)
Stack Handling (Auto RTG + Auto SHC)
OPA, Port of Oslo

- 8 Kalmar zero emission RTGs
- Automated positioning functionality realised with Kalmar TLS
- Kalmar stack profiling system
- Kalmar SmartStack reports container moves automatically to TOS
- Complete data transmission system between the control room and the cranes

"Is offers us greater flexibility for the future, allowing us to take automation to the next level. Efficiency is everything in a country like Norway, where labour costs are high."

Svein Olav Lunde, Director of Technical Operation & Maintenance at the Port of Oslo
Making your every move count