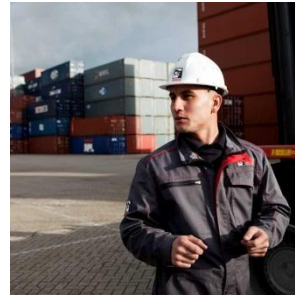


Boosting efficiency and productivity through automation



IAPH, Sydney 2014

Dr. Tero Kokko, Vice President, Horizontal Transportation
11.4.2014

Trends in Market

- Ships becoming bigger and time spent in ports should be shorter
- Safety – even more focus
- Reduction of costs
- Ports and terminals interest towards automation
- Optimum efficiency & space utilization
- Lack of trained & qualified personnel in some areas

Drivers of Automation

- Improving safety of personnel, cargo and equipment
- Reducing cost of operation and variability
- Improving productivity
- Improving capital utilization
- Enabling future growth
- Delivering complete cargo management solutions
- Improving business processes - integrated IT systems improving visibility and information sharing

Kalmar SmartPort. Process Automation.

-80%
Effort
SmartLanes

100%
Visibility
SmartMap

0.00
Containers
Lost
SmartStack
& SmartLifts

6,480
More Moves
SmartRail

10 days
Gained
SmartQuay

46 Hours
Saved
SmartFleet



Automated Stacking Crane

Modularity ensuring
robustness and
performance

Auto - Straddle

Optimum flexibility
in transportation
and stacking

Automated Lashing Platform

Improving safety
and efficiency

Auto - Shuttle

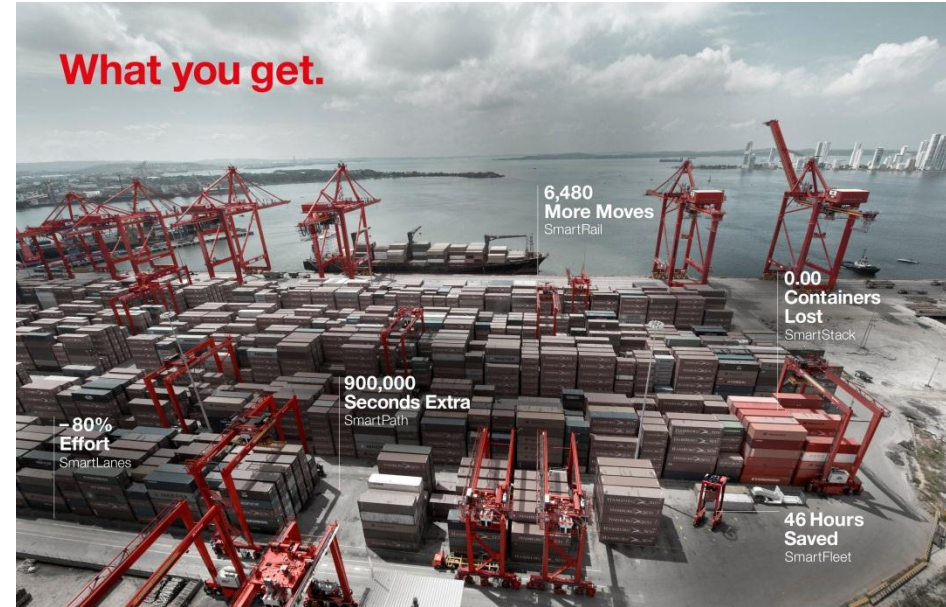
Decoupling quay
and yard crane
work cycles

Kalmar SmartPort Equipment Automation.

Process automation

Process automation

- **Process automation:** Any process being automated through the use of computers and software.
- Automated processes require less human intervention and less human time to deliver
- **Simply put:** Applying technology to improve container handling processes
- **Improves** equipment efficiency
- **Creates** safer working environment



Information drives Efficiency

- With manual processes, it can take several seconds for a job to be started
- An example: exchange between crane and truck during discharge
 - A 3 second delay
 - At a 500,000 TEU terminal
 - With ~300,000 moves
 - Results in 10.4 days of delay
- SmartPort process automation solutions can eliminate delays across all aspects of terminal operations
- And add predictability with operations not dependent on handling of a person

What you see.



What you get.



KALMAR

SMARTPORT

**10 days
Gained**
SmartQuay

**46 Hours
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SmartFleet

**-80%
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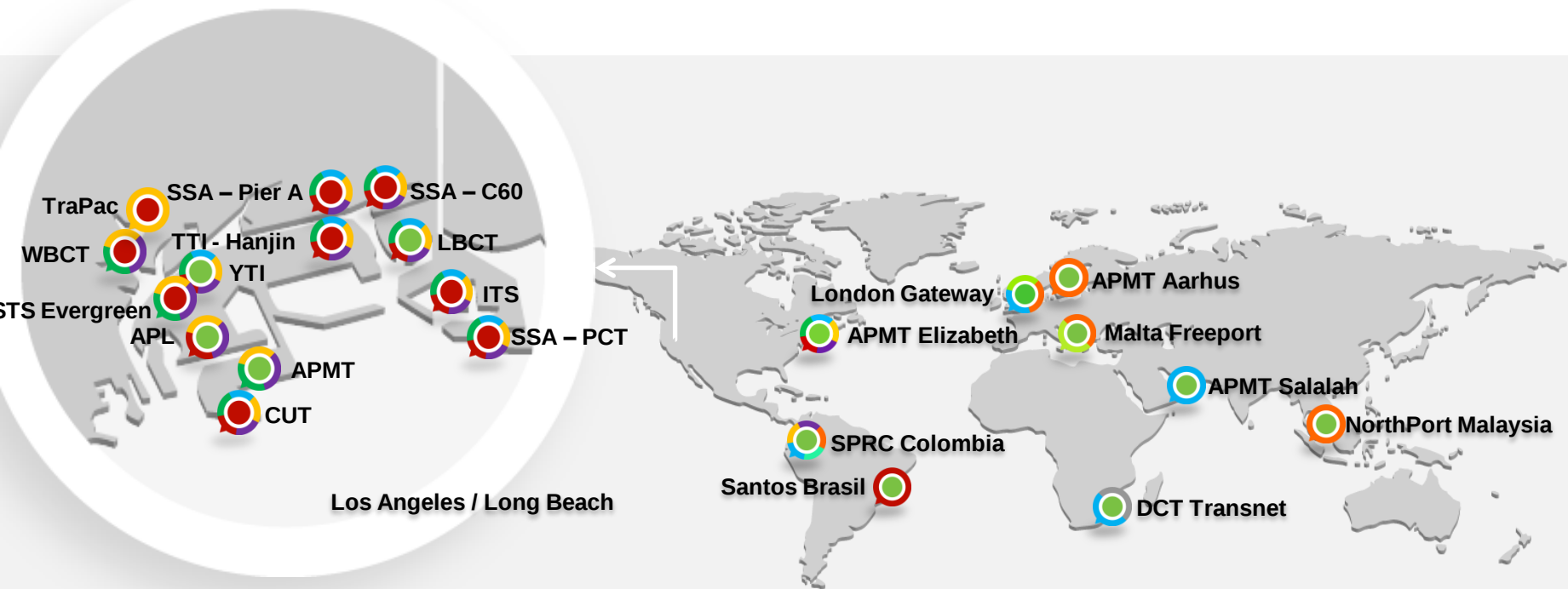
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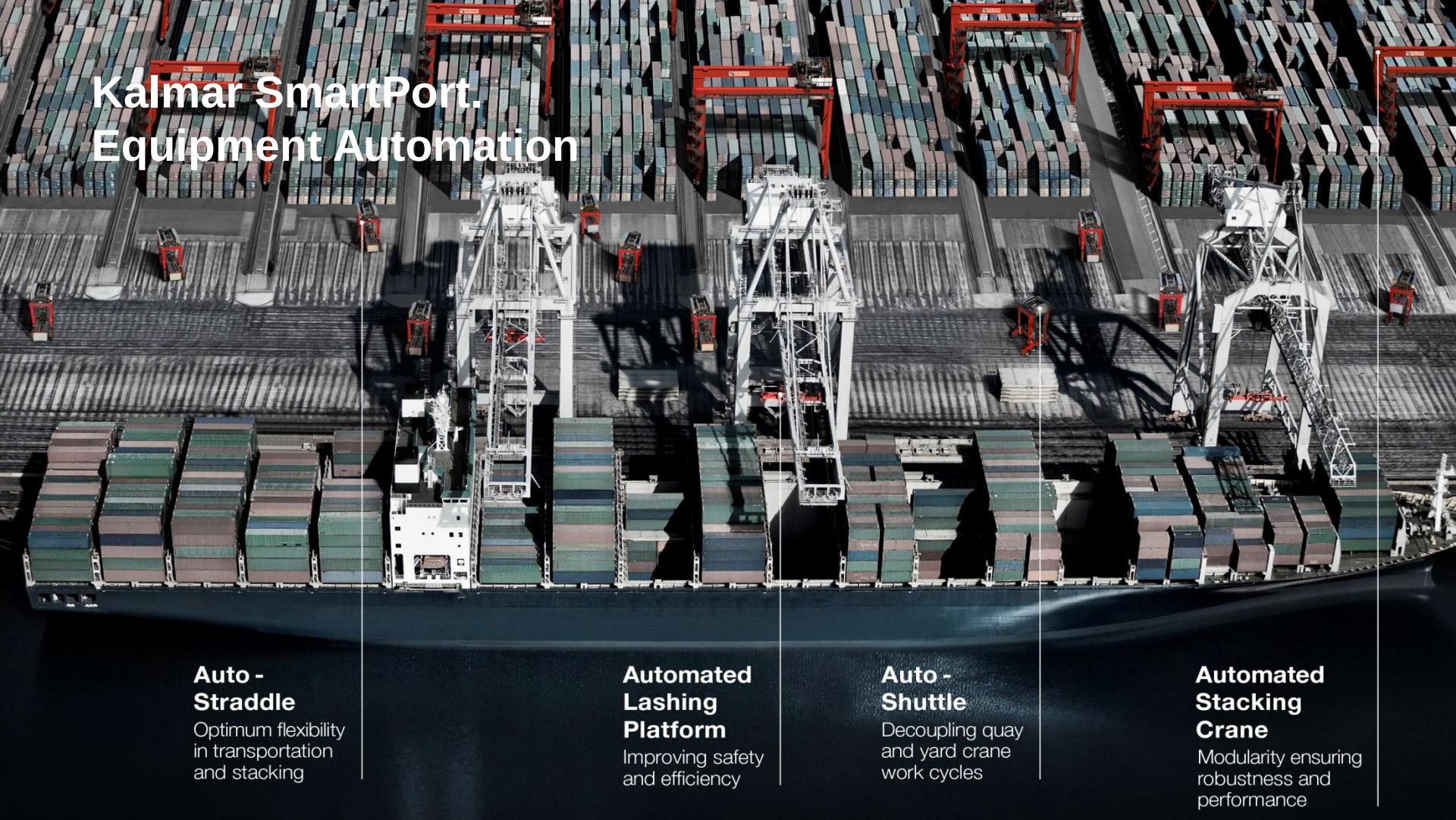
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Containers
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Applications around the globe



- | | | | | |
|-----------|------------|-------------|------------|---|
| SmartQuay | SmartStack | SmartTrucks | SmartFleet | Kalmar SmartPort application |
| SmartLift | SmartLane | SmartPath | SmartRail | Kalmar SmartPort application with Navis TOS |



Kálmár SmartPort. Equipment Automation

Auto - Straddle

Optimum flexibility
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Automated Lashing Platform

Improving safety
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Auto - Shuttle

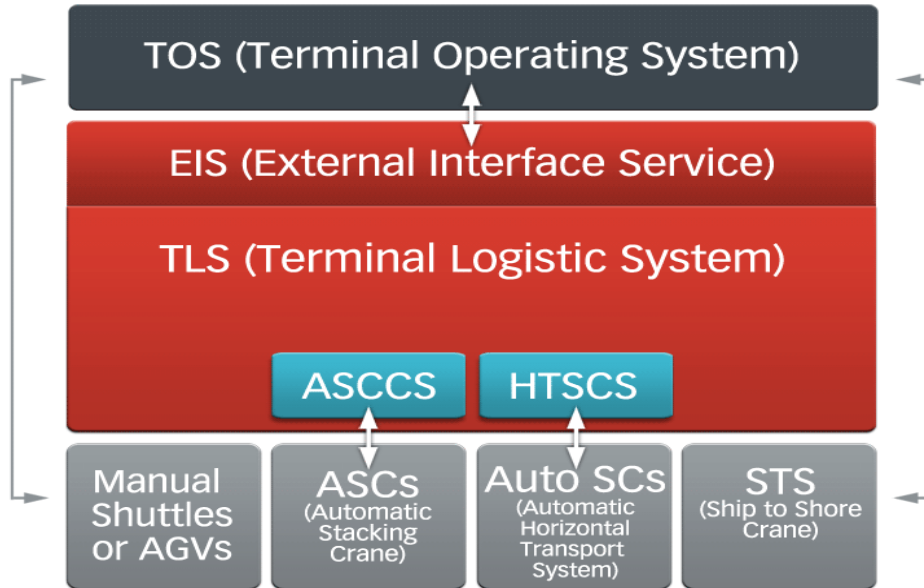
Decoupling quay
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Automated Stacking Crane

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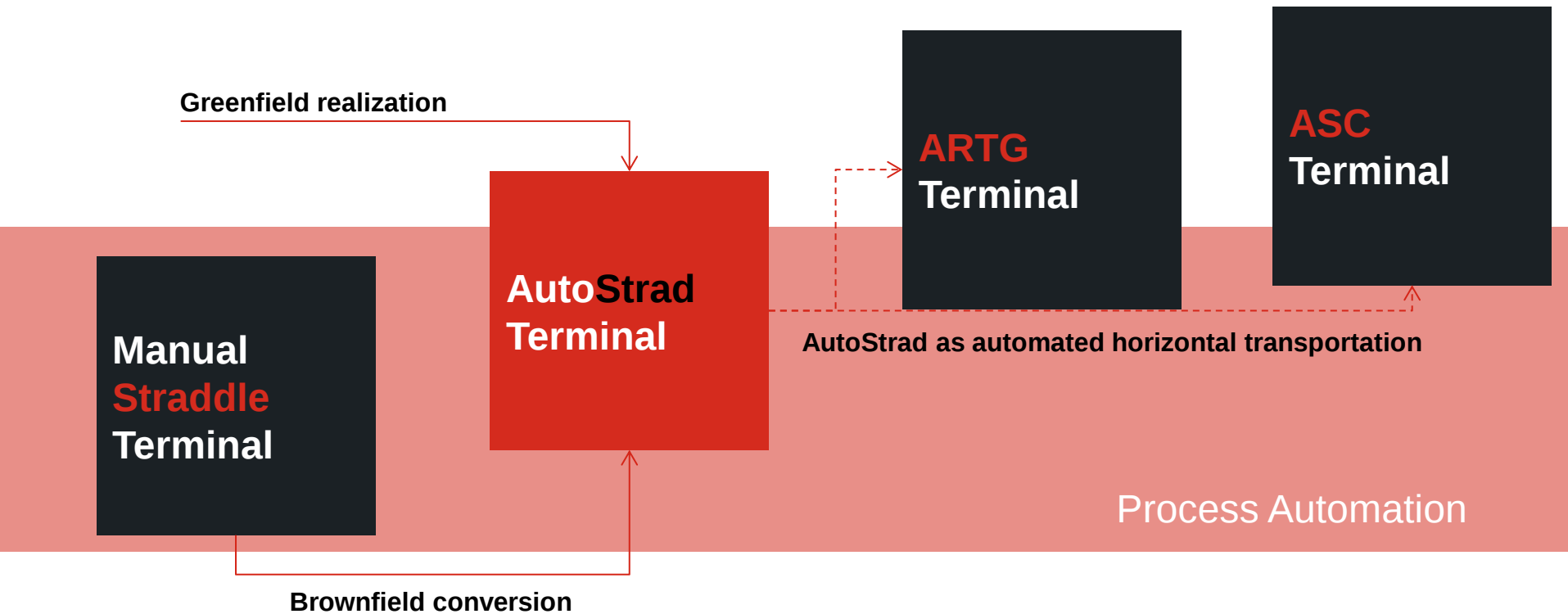
Terminal Logistic System

- Scalability with terminal development steps
- Integrates all systems that serve ASC cranes and blocks in the terminal
- Job dispatching, routing and fleet management
- Common look and feel with all Kalmar automation products (GUI)
- Remote Monitoring and diagnostics tools
- Interfaces to other systems (TOS, Access management, etc.)



AutoStrad - ease of automation

AutoStrad: the ease of automation



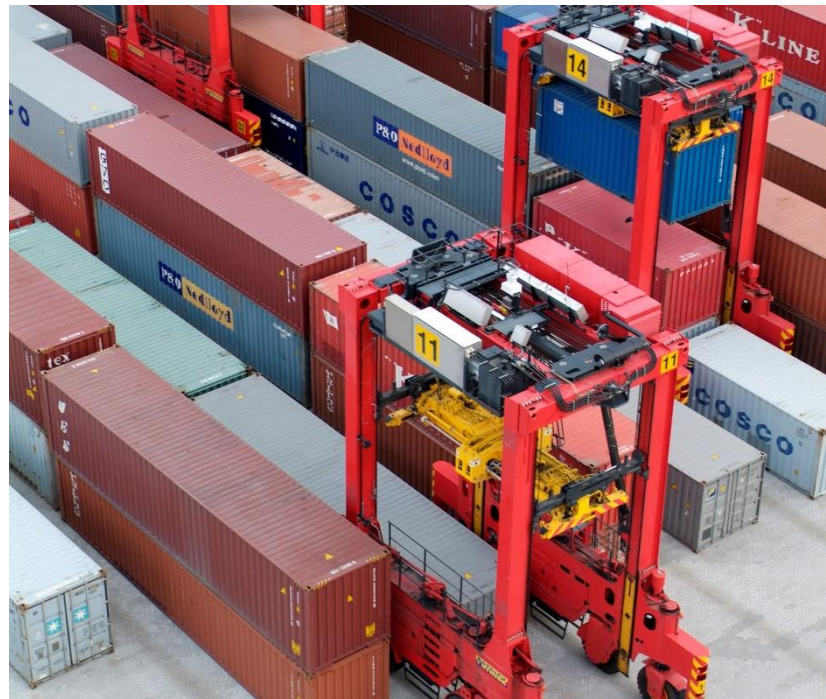
AutoStrad: operational considerations

- Straddle carriers are efficient when:
 - Flexibility is important
 - The terminal area is complicated
 - High stack densities are not required
- Small difference in productivity between 3- and 4-high containers high stacking straddle carriers



AutoStrad: capacity considerations

- Maximum stacking height is 3-4 high
 - Average stacking height can be little higher in export container stacks
 - Average stacking height of import stacks is kept lower than that of export
 - Stacking density 500...750 TEU/ha
- AutoStrad employs random stacking
 - Exports are pre-positioned automatically to the quayline as the ship arrives
 - Imports stack heights and locations can be configured depending on the reliability/availability of truck arrivals



Strad state of the art

- Fully automated self-loading straddle carrier
- Flexible for future growth
- High level of safety and security
- Efficient use of CAPEX
- Very competitive cost of production
- Ready for deployment for new and brownfield projects

ASC and AutoShuttle

Increasing stacking density

ASC + 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 friendliness
- Reduces overall operating costs
- Long lifetime 25 years / 4,000,000 operation cycles





Hybrid AutoShuttle

Superior Performance

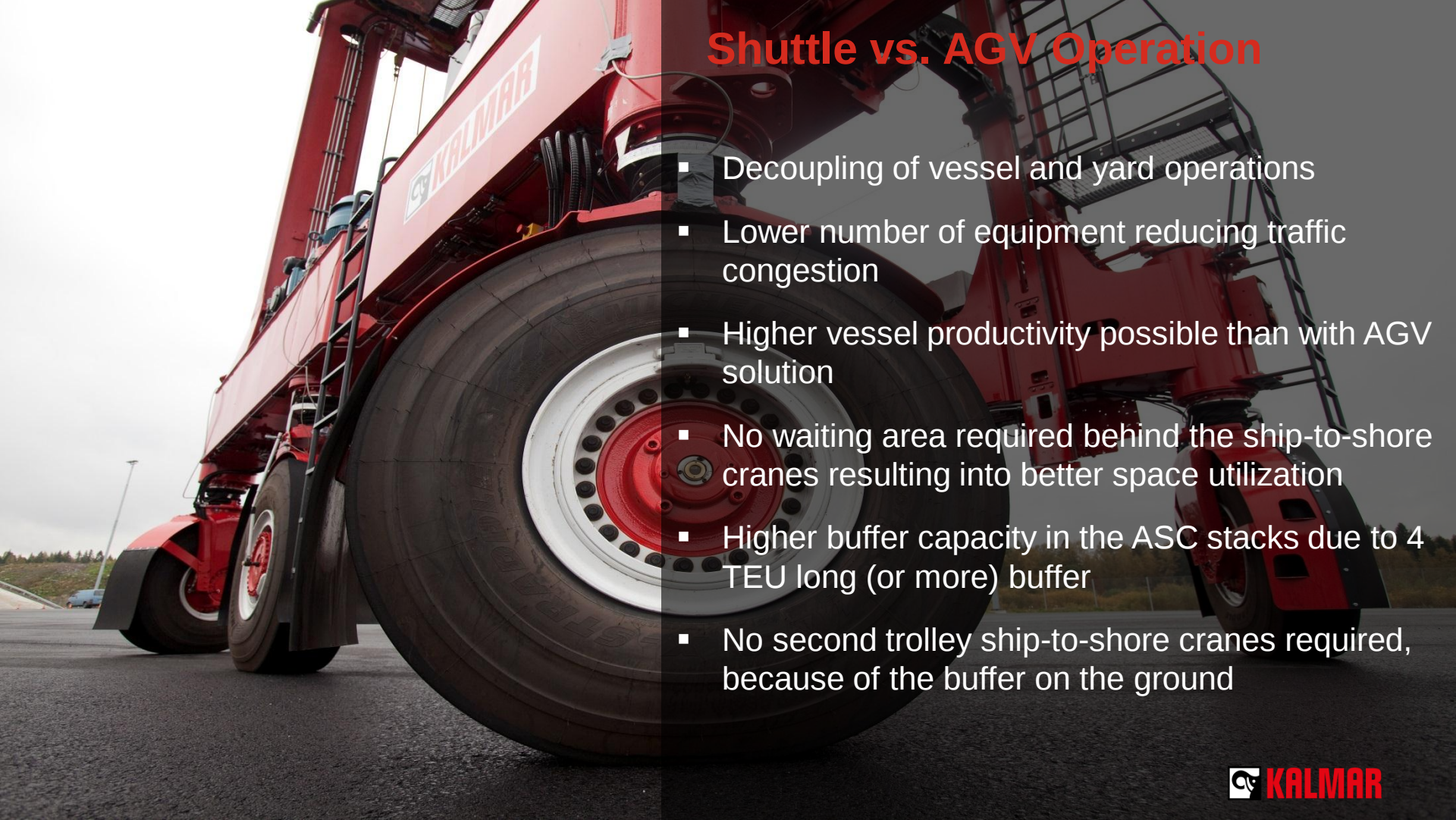
- Highest power & speed
- Lowest fuel consumption in the market
- Lowest cost of operation
- New steering geometry

Sustainability and environment

- Fuel savings up to 40%
- Automatic start & stop function
- Regeneration - Electric braking & hoisting
- Less pollution, noise, oil
- Longer lifetime of equipment

Maintenance

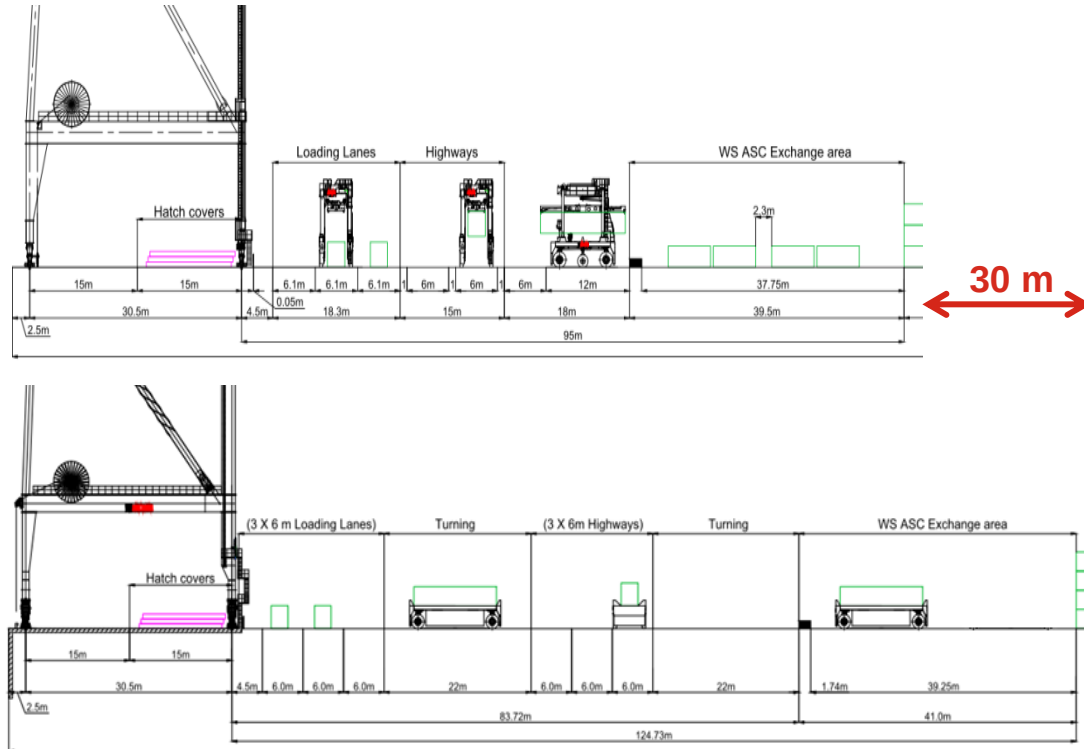
- Extended maintenance intervals
- Energy storage and generator maintenance free



Shuttle vs. AGV Operation

- Decoupling of vessel and yard operations
- Lower number of equipment reducing traffic congestion
- Higher vessel productivity possible than with AGV solution
- No waiting area required behind the ship-to-shore cranes resulting into better space utilization
- Higher buffer capacity in the ASC stacks due to 4 TEU long (or more) buffer
- No second trolley ship-to-shore cranes required, because of the buffer on the ground

Performance: Apron layout



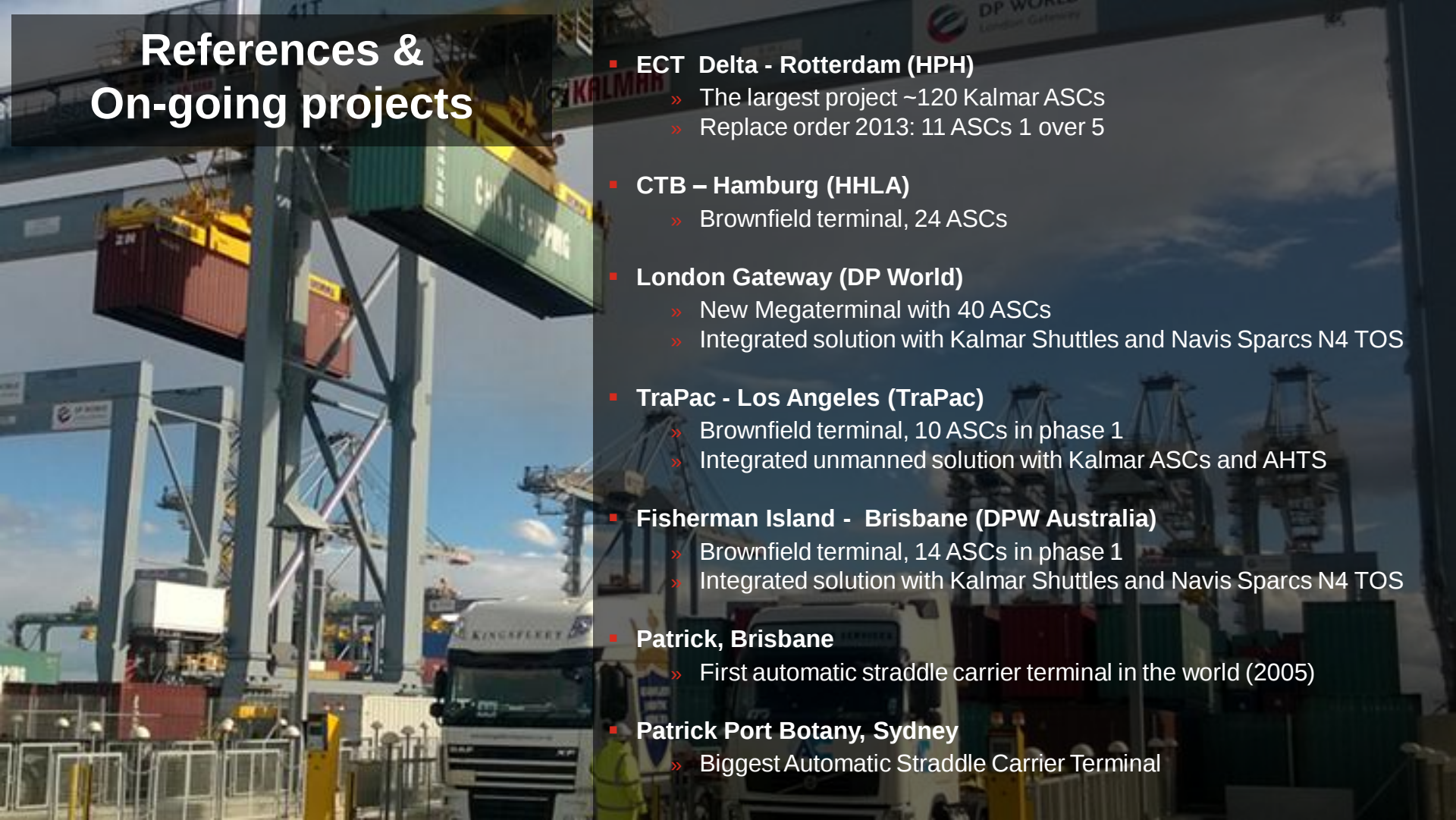
Apron width reduced by 30 m.

- Increased capacity ~5% additional stack capacity
- Reclaimed land savings

Location	Savings
Avarage reclaimed land	6 M€
Tokyo	32 M€
Singapore	117 M€

Based on a quay length of 850 meters and costs of land based on 2006 pricing as shown in the report by the International Association of Dredging Companies

References & On-going projects

The background image shows a busy port terminal. A large yellow straddle carrier is in the process of lifting a green container. In the foreground, a white truck with 'KINGFERRY' written on its side is visible. The terminal is filled with various shipping containers and infrastructure, including cranes and gantries. The sky is clear and blue.

- **ECT Delta - Rotterdam (HPH)**
 - » The largest project ~120 Kalmar ASCs
 - » Replace order 2013: 11 ASCs 1 over 5
- **CTB – Hamburg (HHLA)**
 - » Brownfield terminal, 24 ASCs
- **London Gateway (DP World)**
 - » New Megaterminal with 40 ASCs
 - » Integrated solution with Kalmar Shuttles and Navis Sparcs N4 TOS
- **TraPac - Los Angeles (TraPac)**
 - » Brownfield terminal, 10 ASCs in phase 1
 - » Integrated unmanned solution with Kalmar ASCs and AHTS
- **Fisherman Island - Brisbane (DPW Australia)**
 - » Brownfield terminal, 14 ASCs in phase 1
 - » Integrated solution with Kalmar Shuttles and Navis Sparcs N4 TOS
- **Patrick, Brisbane**
 - » First automatic straddle carrier terminal in the world (2005)
- **Patrick Port Botany, Sydney**
 - » Biggest Automatic Straddle Carrier Terminal



Making Your Every Move Count.