



Merenkulun automaatio ja autonomia – missä mennään?

Autonomous Operations at Cargo Terminals

Cargotec in brief

Cargotec enables smarter cargo flow for a better everyday with its leading cargo handling solutions and services. Cargotec's business areas Kalmar, Hiab and MacGregor are pioneers in their fields. Through their unique position in ports, at sea and on roads, they optimise global cargo flows and create sustainable customer value.

- Sales 2018: EUR **3.3** billion
- Around **12,000** employees
- Class B shares are quoted on the Nasdaq Helsinki Ltd





PURPOSE

SMARTER CARGO FLOW FOR A BETTER EVERYDAY

#SMARTERBETTERTOGETHER

VISION

GLOBAL LEADER IN INTELLIGENT CARGO HANDLING

MUST-WIN BATTLES

WIN THROUGH CUSTOMER CENTRICITY

We help our customers achieve their goals by aligning our offering and way of working to serve them better.

ACCELERATE DIGITALISATION

We build and expand our digital solutions to offer a great customer experience and more efficient business processes.

ADVANCE IN SERVICES

We extend our offering towards intelligent solutions that enable us to serve our customers wide across their lifecycle.

PRODUCTIVITY FOR GROWTH

We focus on activities that add value and benefit our customers and us by developing our business operations and common platforms.

OUR WAY OF WORKING

LEAD WITH PURPOSE

EMPOWER FOR PERFORMANCE

COLLABORATE TO WIN

Offering for eco-efficiency for more sustainable future



Systems efficiency

Visibility to identify inefficient use of resources and fuel

Software and cargo stowage design system



Efficiency for environmental industries

Offering to support the operations in environmental industries

Cargotec solutions for environmental industries



Emission efficiency

Technology to enable fuel and emission efficient offering

Products with features to decrease fuel usage and avoidance of maritime hydraulic oil emissions



Resource efficiency

Service enabling the extended usage of products or new applications

Product conversions and modernisations

Our purpose: we shape cargo handling

 **MAGGREGOR**

 **KALMAR**

 **HIAB**



 **CARGOTEC**

Megatrends

- Consuming population
- Urbanisation
- Growing energy demand
- Digitalised world

Customers need solutions for
Better efficiency
Sustainability
Safety

Global industry leader
Service and software offering,
equalling 40% of revenue.

2020 Leader in intelligent cargo handling

2018 Services leadership

Engaging and developing world-class leadership

Leading in cargo flow digitalisation

Building a world-class service offering

2016 Leader in cargo handling equipment

We will win by

We shape the future of cargo handling

The future will be automated



Safety



**Cost
competitiveness**



**Operational
flexibility**

Kalmar's operating environment



Provides integrated port automation solutions including software, services and a wide range of cargo handling equipment



TOS coordinates and optimises the planning and management of container and equipment moves in complex business environments.

Navis provides also maritime shipping solutions:

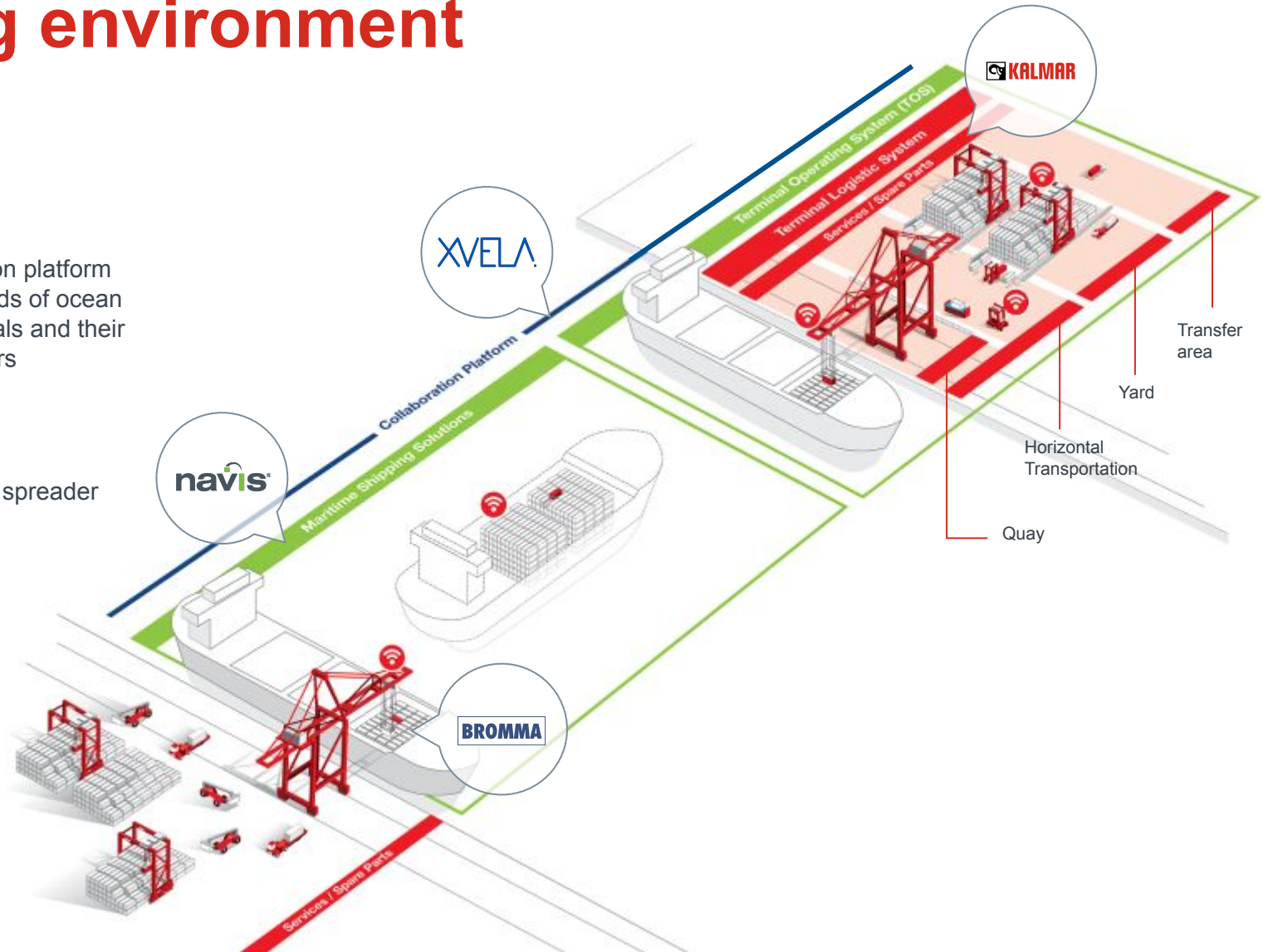
- Stowage planning
- Vessel monitoring
- Loading computer
- Route planning

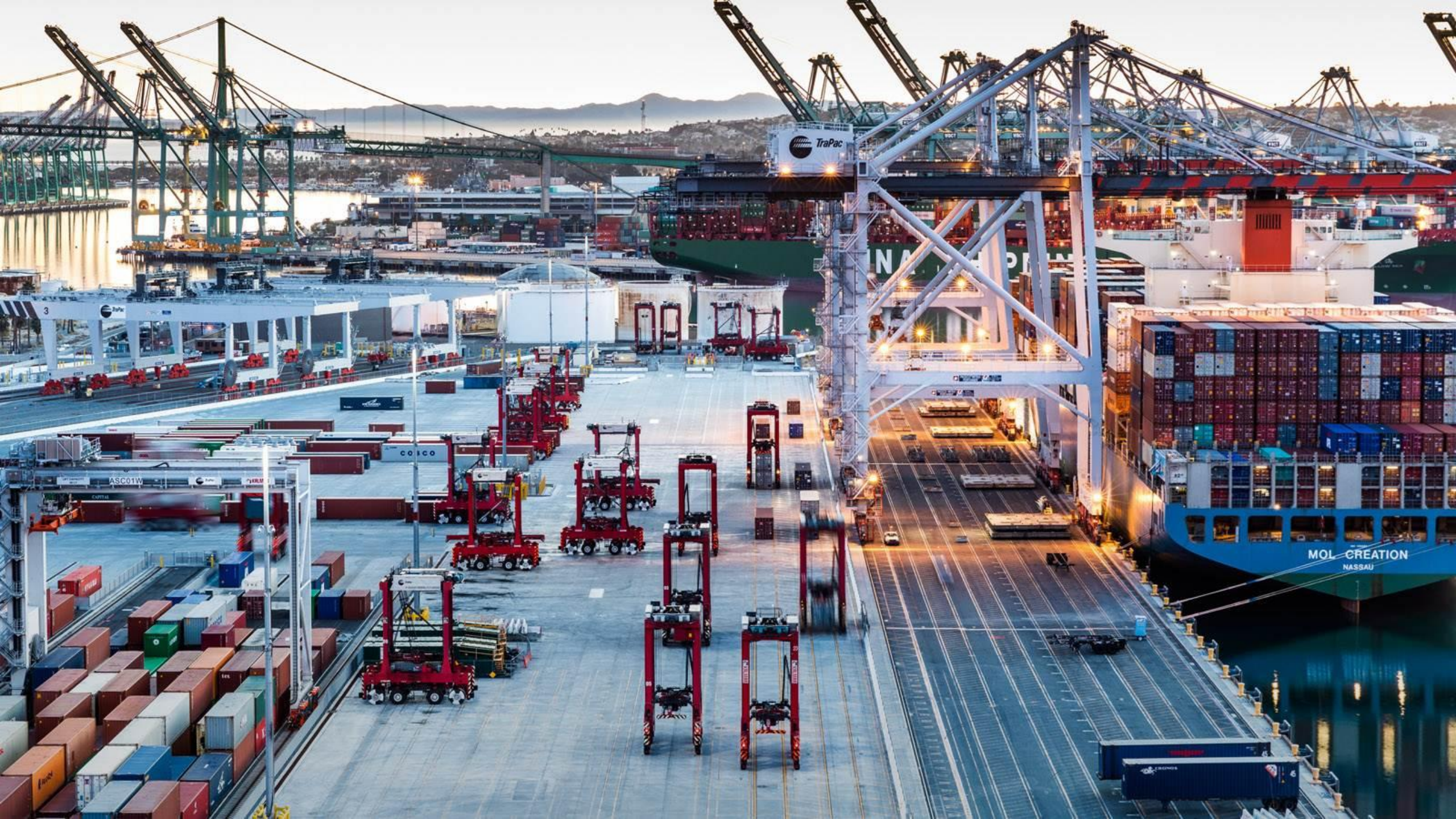


The collaboration platform serving the needs of ocean carriers, terminals and their shipping partners



Industry leading spreader manufacturer





TraPac

INA

MOL CREATION
NASSAU

3

ASC01W

COICO

6

Kalmar Automation Solution

Three layers of automation

Terminal Operating System (TOS)

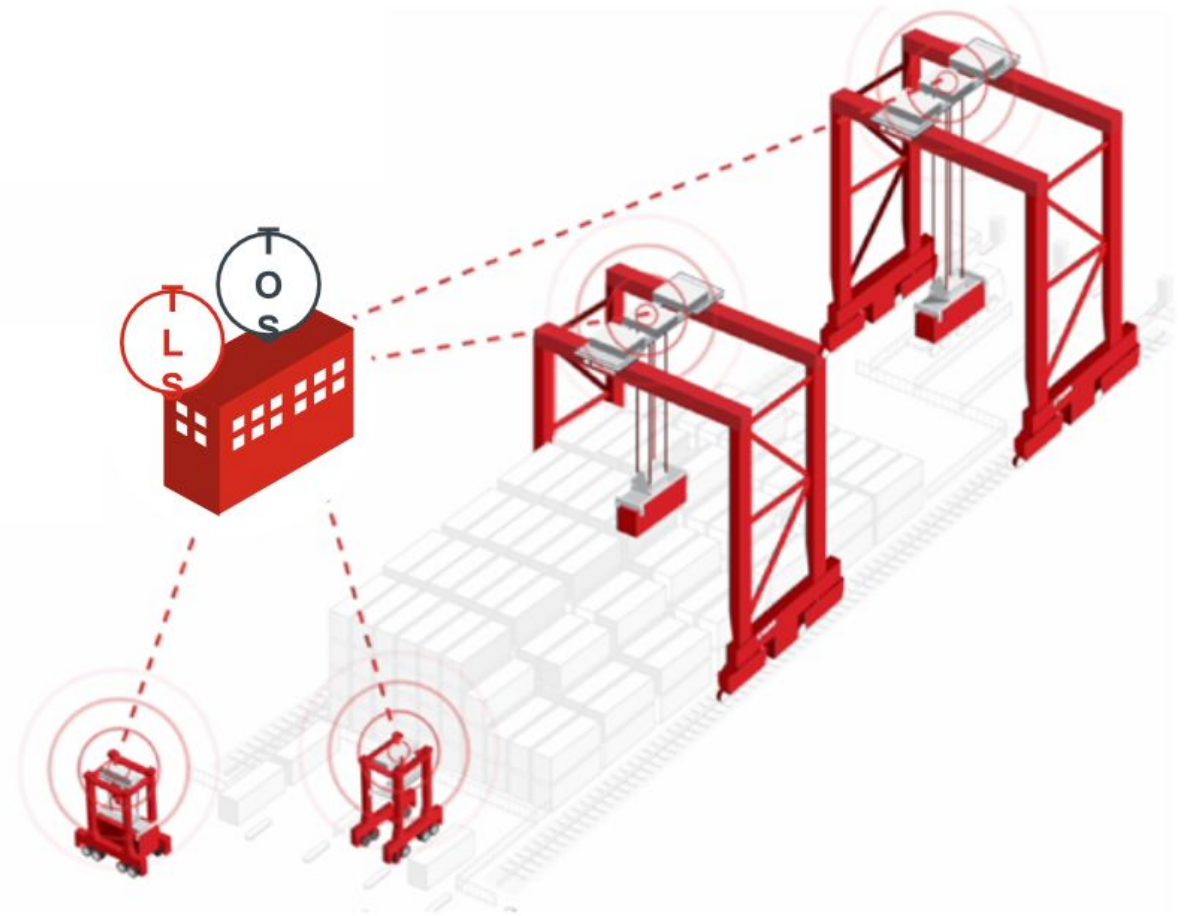
- Plan your container moves
- Optimise your port operations

Equipment Control System = Kalmar Terminal Logistics System (TLS)

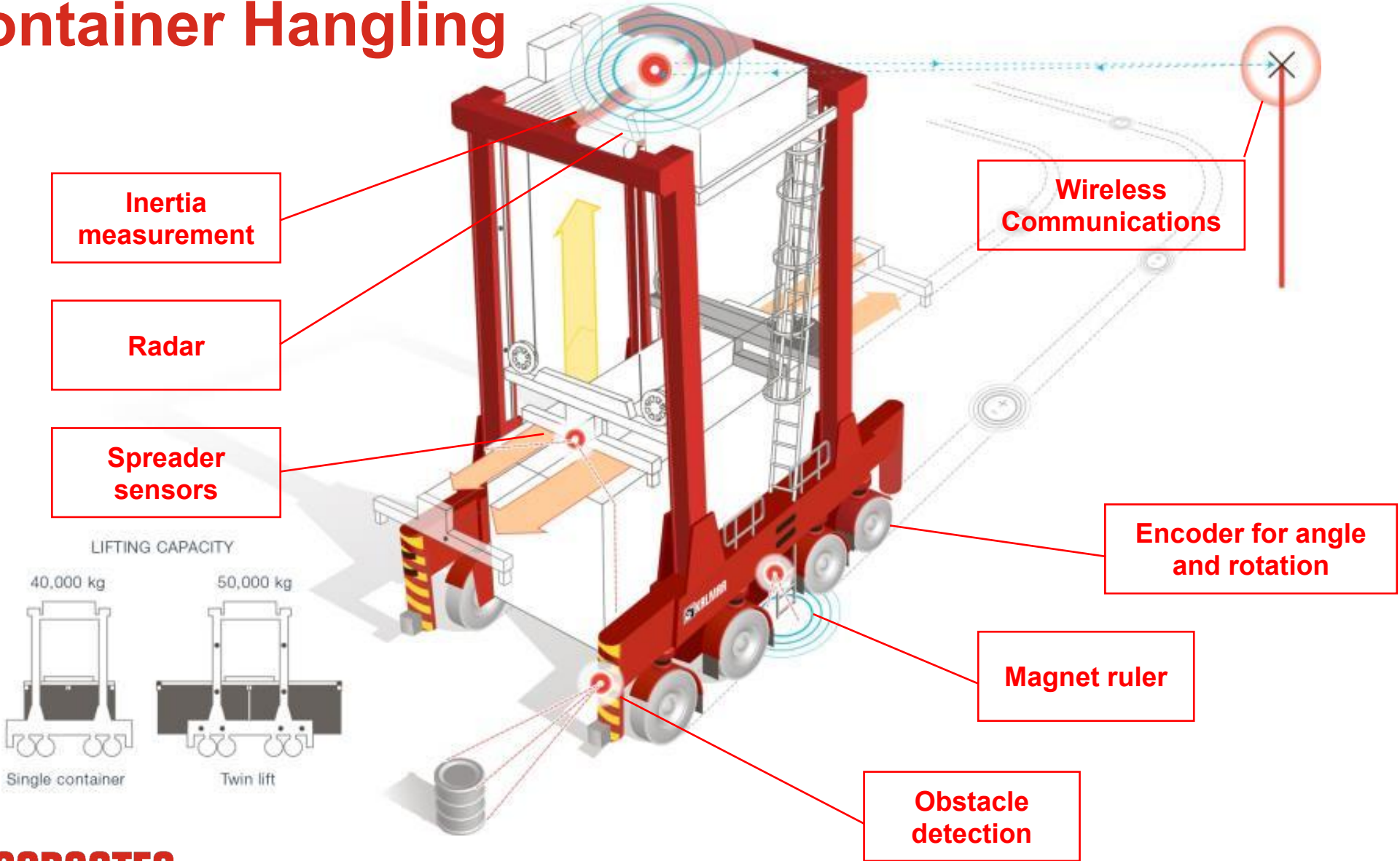
- Control your equipment fleet to operate optimally

Equipment automation

- Machine control system for individual equipment control
- Manages communication between TLS and TOS



Enabling Automated Container Hangling



Automation levels

Step-by-step approach
minimize technical risk

Step 1 Remote Controlled Equipment

1.1 Remote Controlled Equipment

- Driver located to the office
- Optionally TOS integration

1.2 Supervised moves

- Automated supervised moves
- TOS integration

Manual Operation

- Driver assisted features

Step 2 Automated Equipment

2.1 Semi-Automated

- Automated selected moves and pick & ground in stack area
- Supervised moves
- RC operated exception handling

2.2 Automated

- Automated pick & ground in stack area
- Automated gantry movements
- RC operated truck lane and exception handling
- Optionally housekeeping

Step 3 Fully Autonomous

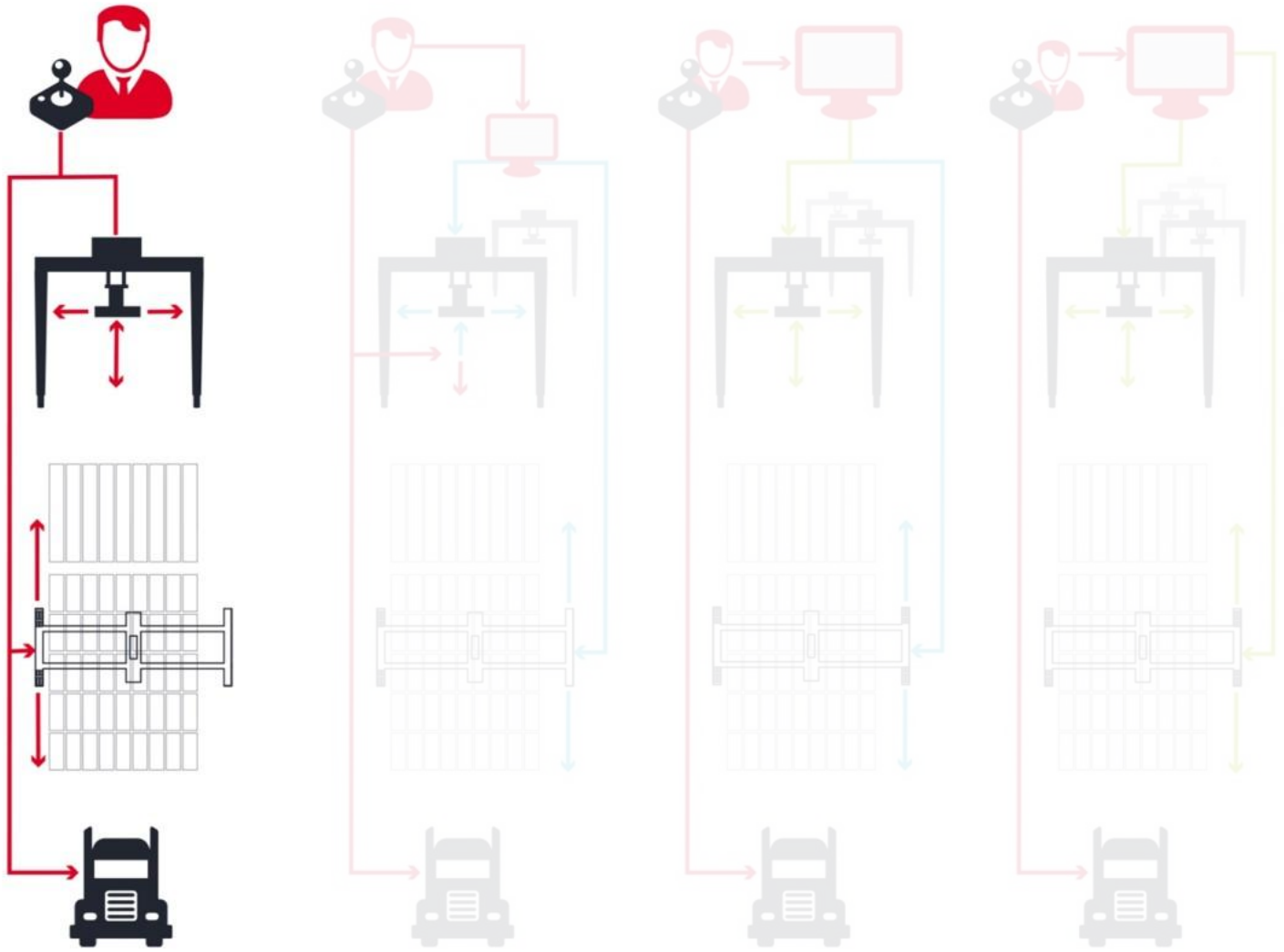
- All operations automated
- Monitoring (remotely) through SW
- RC operation possible for exception handling

Remote control.

Supervised automatic moves.

Automatic pick and place on stack.

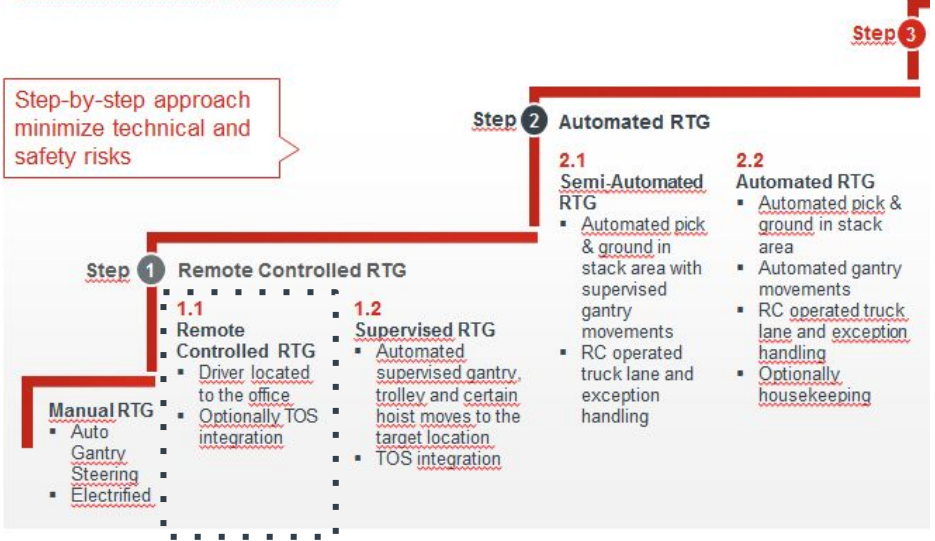
Automatic gantry.



— Remote controlled moves — Supervised moves — Automatic moves

Automation levels

Step-by-step approach minimize technical and safety risks

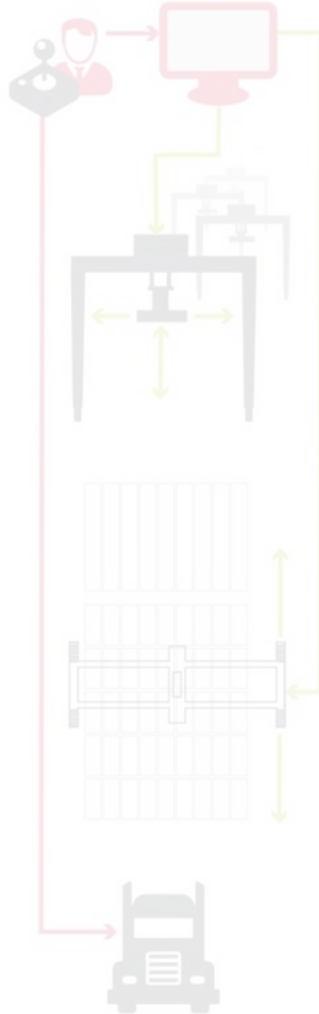
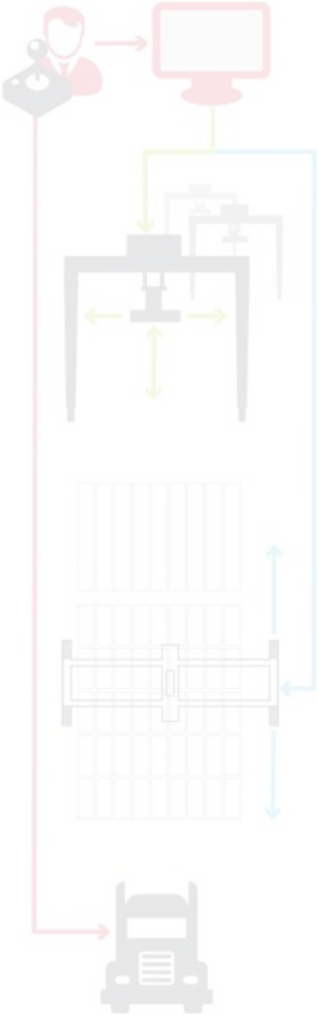
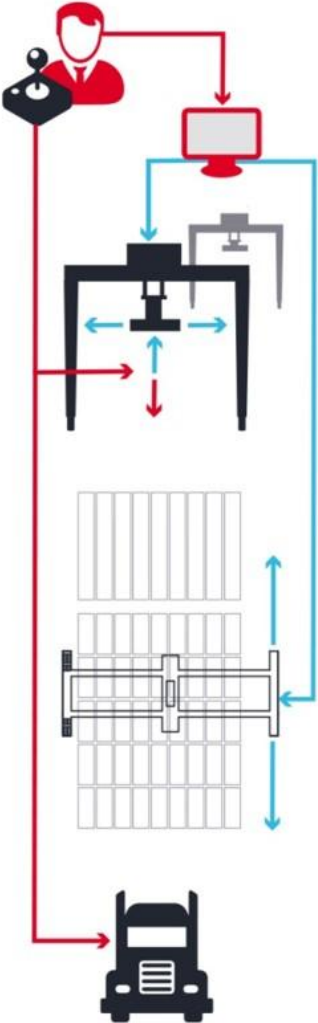
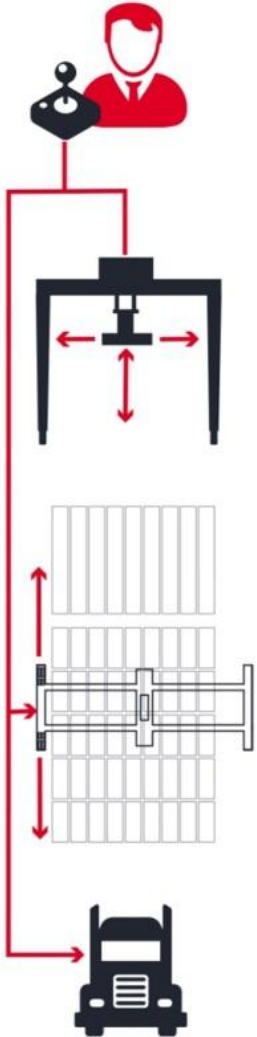


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Supervised automatic moves.

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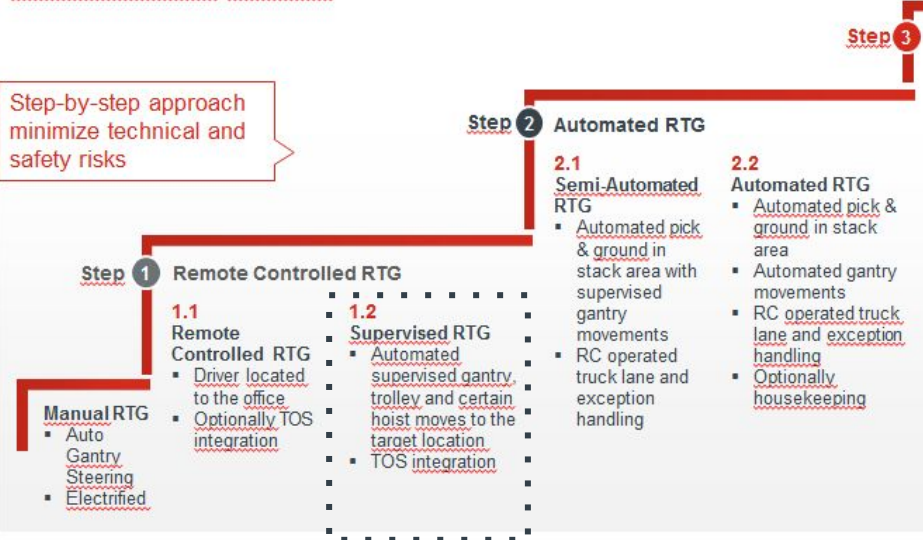
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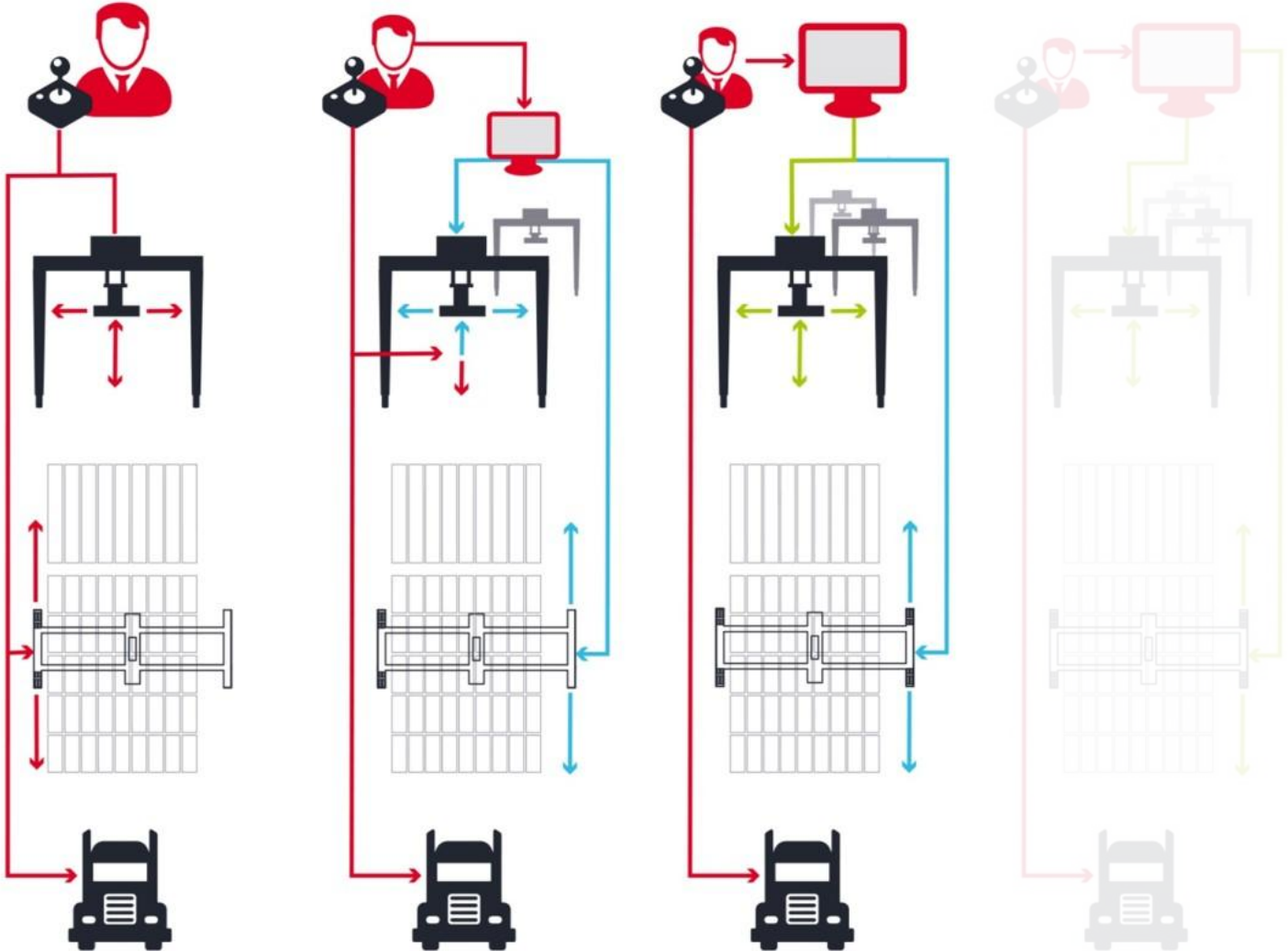


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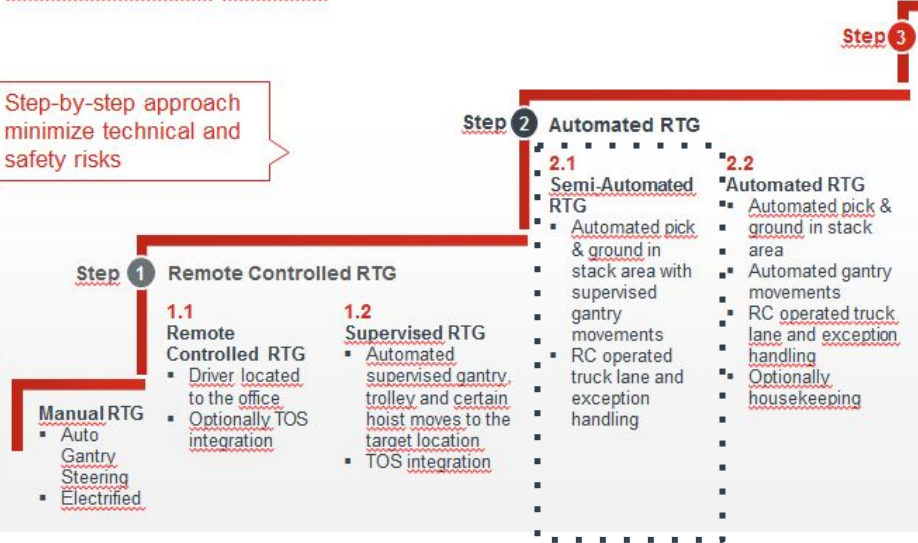
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Automation levels

Step-by-step approach minimize technical and safety risks



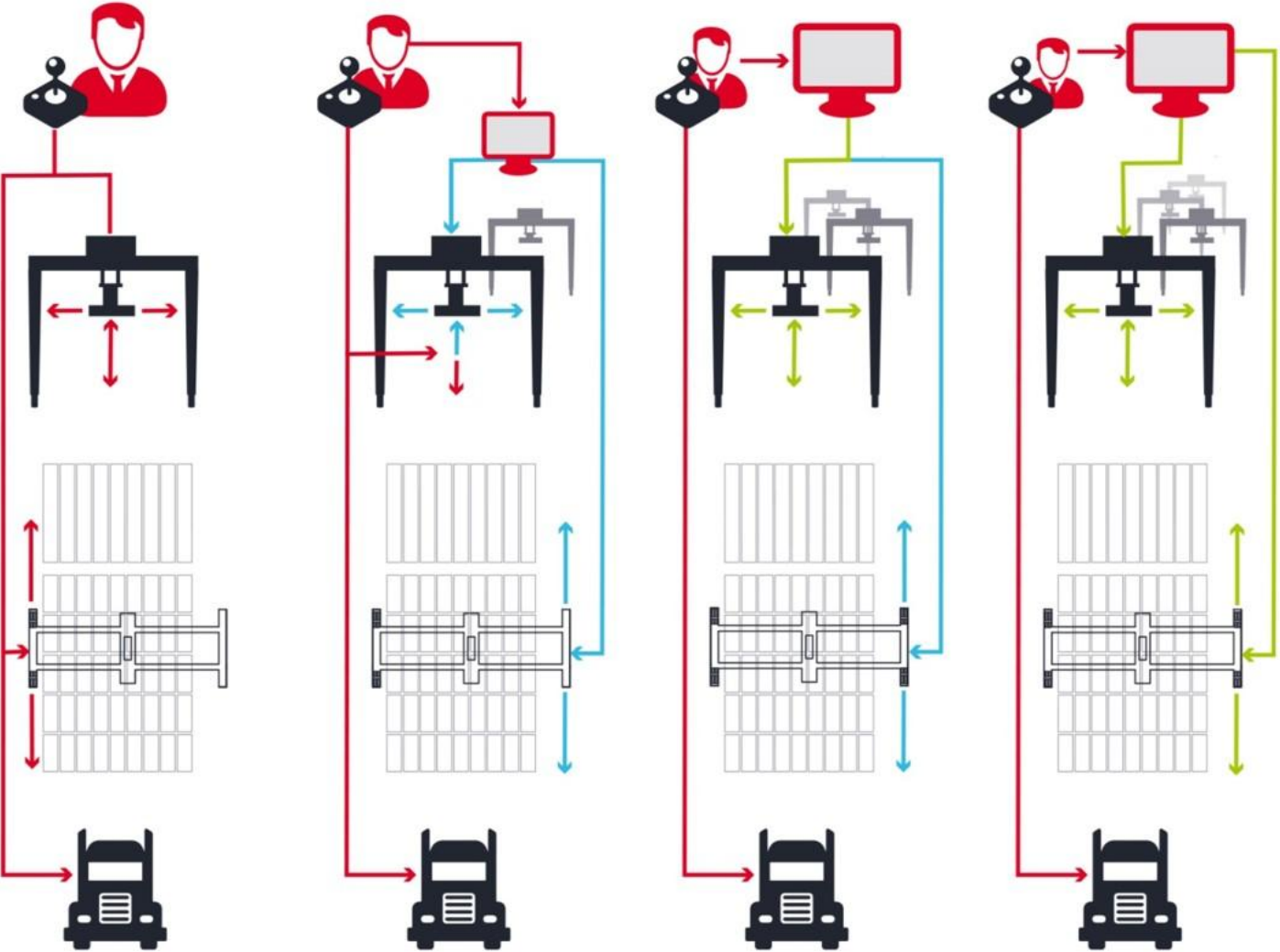
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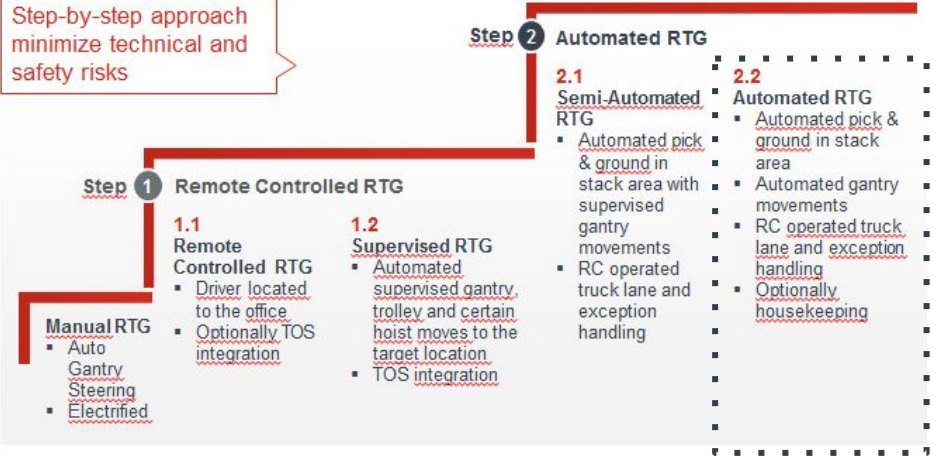
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Automation levels



— Remote controlled moves — Supervised moves — Automatic moves

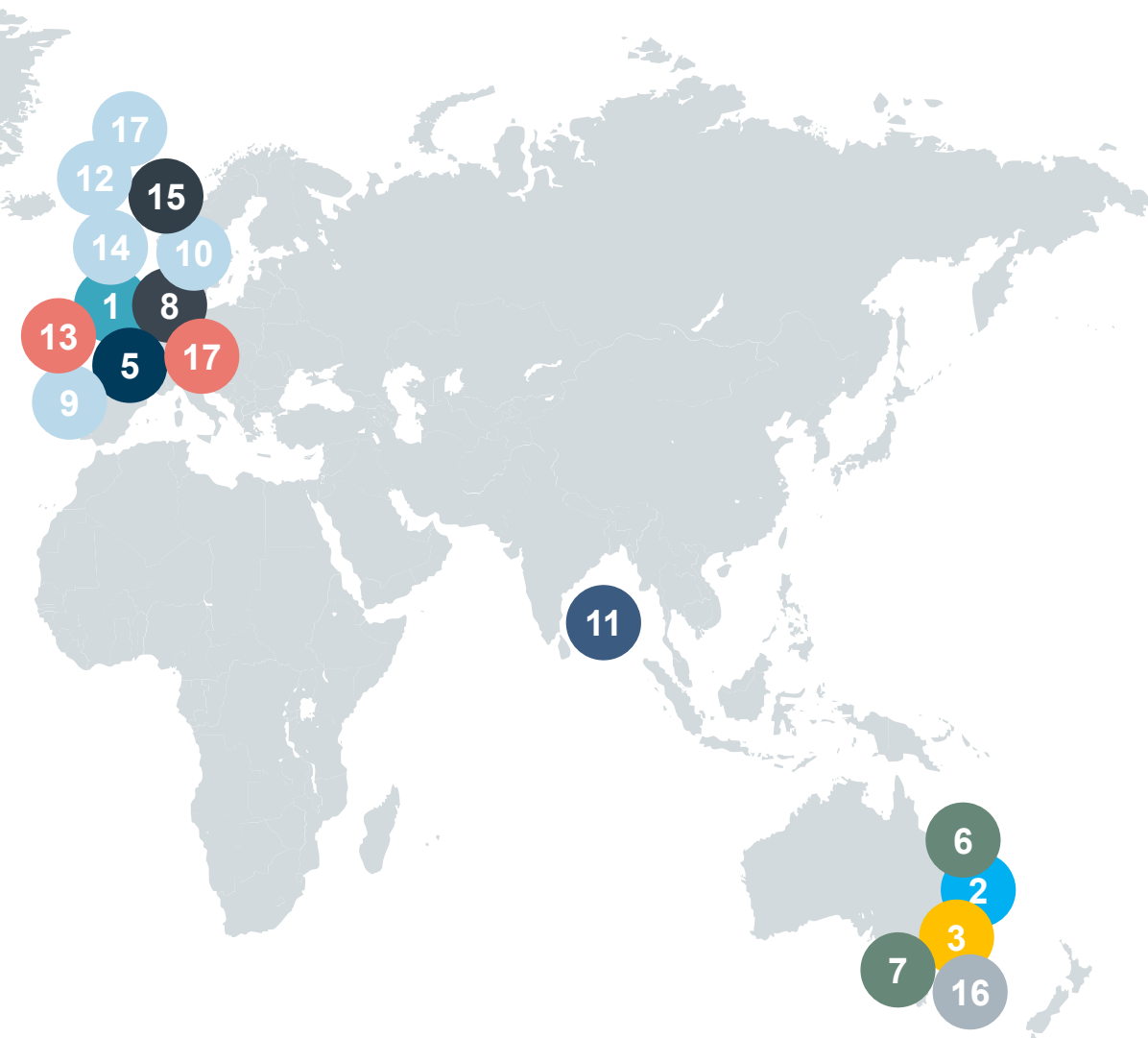
Step-by-step approach minimize technical and safety risks



Kalmar automated terminal references

- Kalmar ASCs and Kalmar shuttle carriers
- Kalmar ASCs and Kalmar AutoShuttles™
- Kalmar ASCs and Kalmar AutoStrads™
- Kalmar ASCs and Kalmar straddle carriers
- Kalmar AutoStrads™
- Kalmar ASCs
- Kalmar AutoRTGs
- Kalmar AGVs
- Kalmar AutoRMGs
- Kalmar AutoRMG + FastCharge™ AutoStrad
- Kalmar ASCs +AutoRMGs + FastCharge™

- | | |
|---|---|
| 1. DPW, London Gateway Terminal, UK | 10. Yilport/Oslo Port Authority, Norway |
| 2. DPW Brisbane Terminal, Australia | 11. PSA Pasir Panjang, Singapore |
| 3. VICTL Melbourne, Australia | 12. Dublin Ferryport Terminal, Dublin Ireland |
| 4. TraPac, Los Angeles, USA | 13. Noatum, Bilbao Spain |
| 5. ECT Delta terminal, Netherlands | 14. Borg Havn IKS, Gamle Fredrikstad, Norway |
| 6. Patrick terminal Brisbane, Australia | 15. Yara Birkeland, Norway |
| 7. Patrick Terminal Sydney, Australia | 16. Qube Moorebank Logistic Park, Australia |
| 8. HHLA Container Terminal, Germany | 17. Rotterdam Short Sea Terminal, Netherlands |
| 9. PSA Sines, Portugal | 18. Belfast Container Terminal |



VICTL Melbourne Australia

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Terminal setup

- › Greenfield, fully automated
- › ASCs and AutoShuttles™
- › Phase 1 - 600.000TEU

Equipment & software

- › 12 Kalmar ASCs
- › in Phase 2 8 ASCs more in delivery
- › 11 Kalmar AutoShuttles™
- › Kalmar TLS
- › Kalmar automated truck handling
- › Navis N4 TOS
- › System Integration Service

Comment

The ability to integrate and link several components into a one seamless process brings true value to the customer. As a system integrator, Kalmar provides a solution, all the way from the TOS, TLS automation, software, equipment, services and consulting to the integration services that bring an automated terminal together.

“Through Kalmar, we will be able to leverage their knowledge and experience from similar automation projects throughout the world and get an integrated system comprising the equipment TLS from Kalmar and the terminal TOS from Navis. We believe that this approach to use a key partner for equipment and software services will help us optimise the operational performance for the future.”

Christian R. Gonzalez
ICTSI head of the Asia-Pacific region



Dublin Ferryport Terminal Dublin, Ireland

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Terminal setup

- › Brownfield – modify from a diesel RTG to an electric semi automated operation
- › 2 cranes per block
- › 450.000 TEU

Equipment & software

- › 2 Kalmar AutoRTG's
- › Kalmar TLS
- › Softpak

Comment

DFT wanted to become a greener terminal by installing new electric RTG's and at the same time wanted to provide on board automation tools that would assist the driver in his day to day operations that would improve productivity.

DFT realised that by deploying the above allowed for the removal of the driver from the RTG into an office environment which has improved their wellbeing while still maintaining the highest standards of safety and customer service.

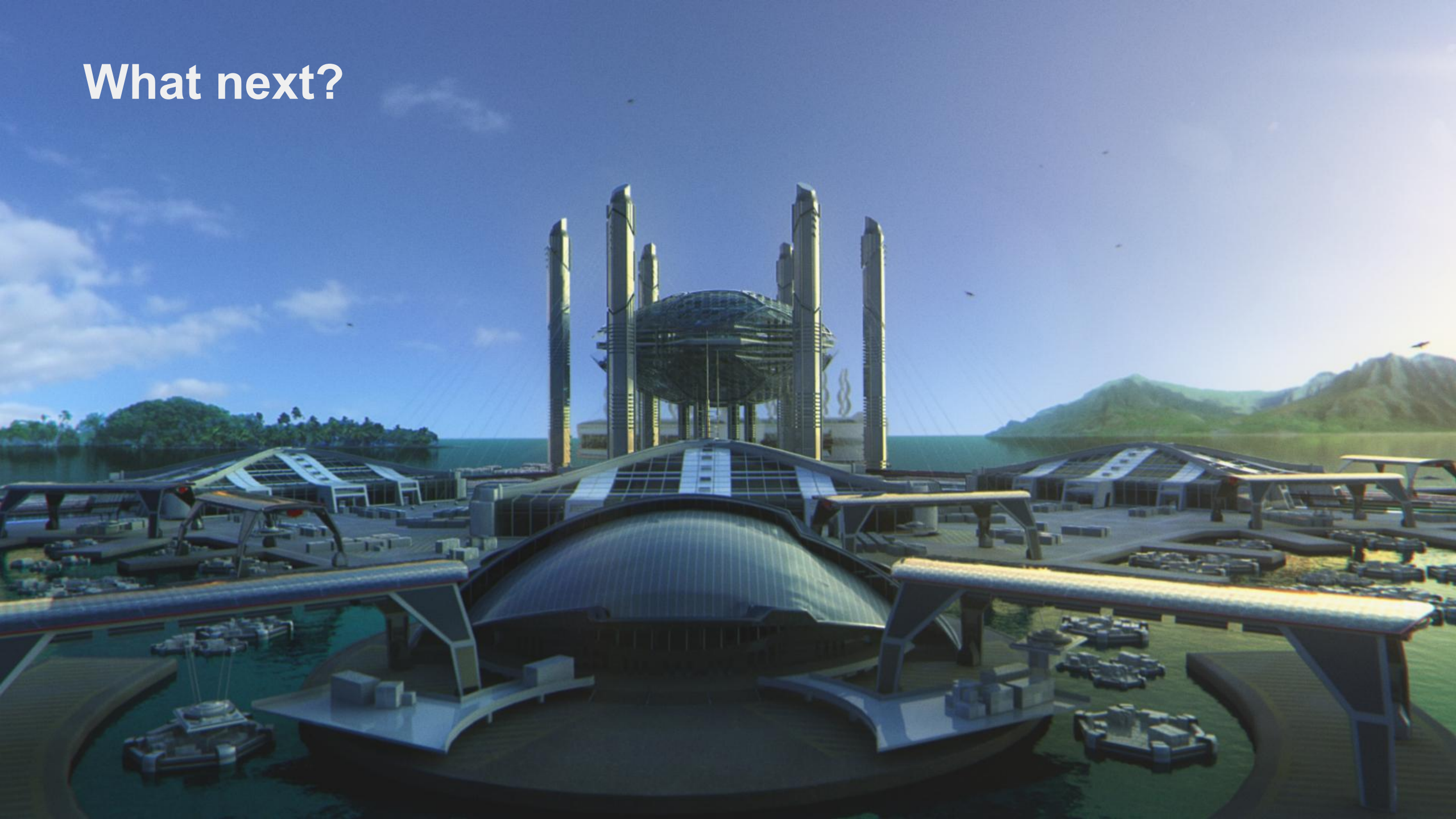
As a trusted long term supplier with a demonstrated ability to deliver on our expectations with the latest driver assisting, semi-automated and automated solutions, and their commitment to be a technology leader in this area, Kalmar stood out as the ideal partner for our company.

Alec Colvin
GM, Dublin Ferryport Terminal



<https://www.youtube.com/watch?v=PO-lmRZK2yI>

What next?



Biggest Challenges Seen



57%

Poor coordination
between partners



50%

Too little transparency
and visibility



37%

Inefficiencies within
the supply chain

Kalmar Insight

Turning data into actionable, impactful insights.

Kalmar Insight™ interface



Data integration with other systems



Kalmar Insight™

Performance data from operations



INTERMODAL

DISTRIBUTION CENTRES & WAREHOUSES

PORTS & TERMINALS

FORESTRY & METAL HANDLING



Maintenance scheduling and management

Easy maintenance planning: Maintenance module enables automated spare parts recommendations and ordering.



Playback mode of historical data

Shows process bottlenecks and help to identify areas for improvement.



Single view for all equipment types and brands



Everything at a glance

Simple to use and understand: data can be accessed with any device – smartphone, tablet, laptop or desktop.

<https://demo.insight.mykalmar.com/site/overview>



Many-to-Many Business Network



Digital service layer segments in maritime logistics

