Digitalization & Automation of Terminal Processes

Intermodal Africa 2022 – King Fahd Hotel, Dakar, Senegal

Tuesday June 28th to Thursday June 30th.
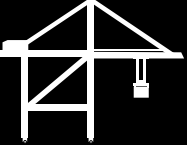
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Process Efficiency
Content
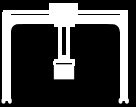
1	Cranes automation
2	Camera Technology
3	Equipment Logistics and Warehouse Management
4	Remote Control
5	Reference projects

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Different Crane Types - Maturity & Degree of Automation

Crane type	Sub-type	Automation Degree	Status
STS	Single trolley	◕	LS - Trolley-mounted sensor critical WS – under development
	Double trolley	◔	LS – several units in commercial operation WS - development
RMG	Portal (ASC)	●	Ca. 1000 units in commercial operation Most ASC with AGV, strad and truck Truck driver present in cabin
	Cantilever (ARMG)	◕	
RTG	16-wheel	◕	First units in commerical operation 16-wheel more stable than 8-wheel Truck under RTG in truck lane Unresolved „personnel safety"
	8-wheel		
Strad		●	First units in Commercial operation

Legend:
- ● Fully automated with manual intervention
- ◕ Semi-automated with extensive driver assistance
- ◔ Semi-automated with limited driver assistance

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Quay cranes automation
Typical Level of automation

Auto

Manual
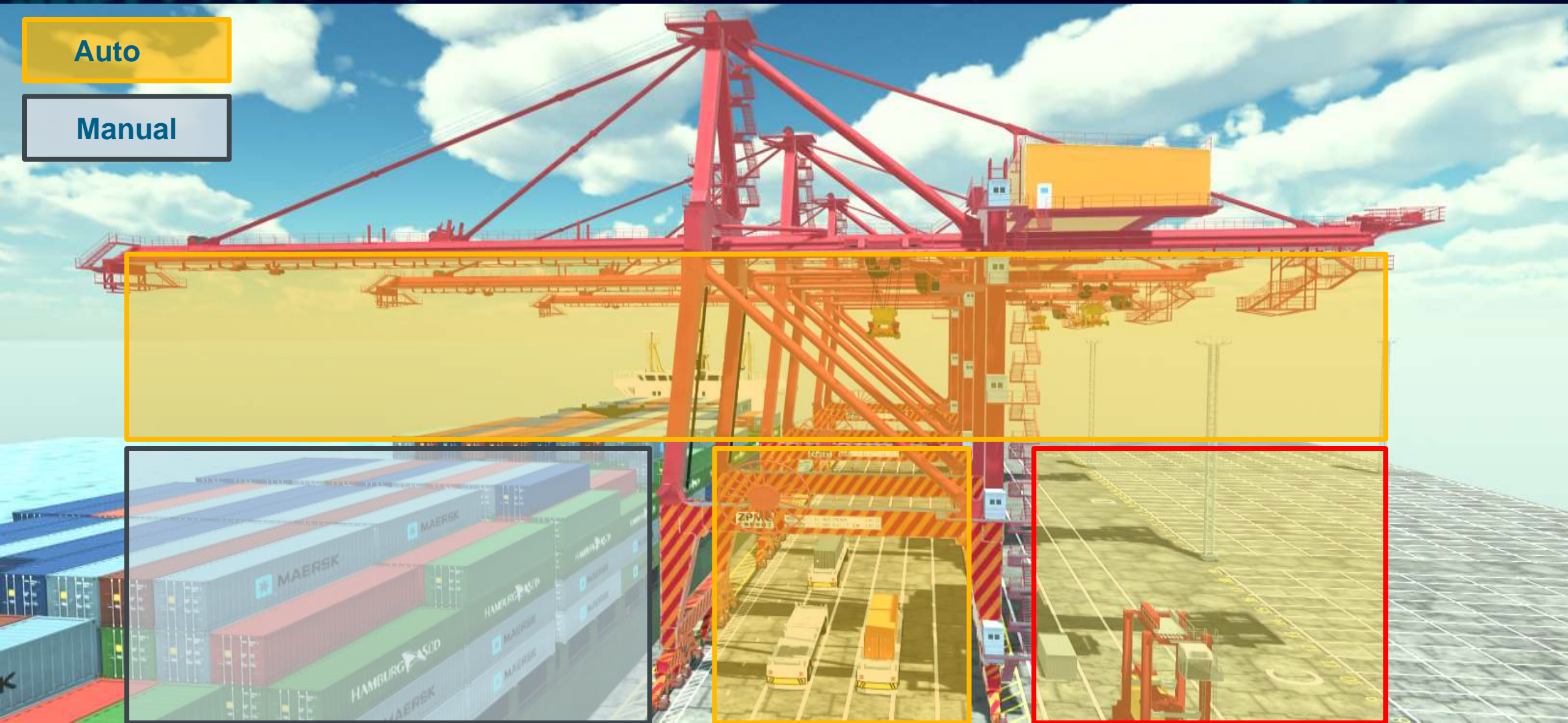
Quay cranes automation
Hot topics

Digitalization
- Simulation
- Terminal Supervisory Syst.
- Predictive Maintenance
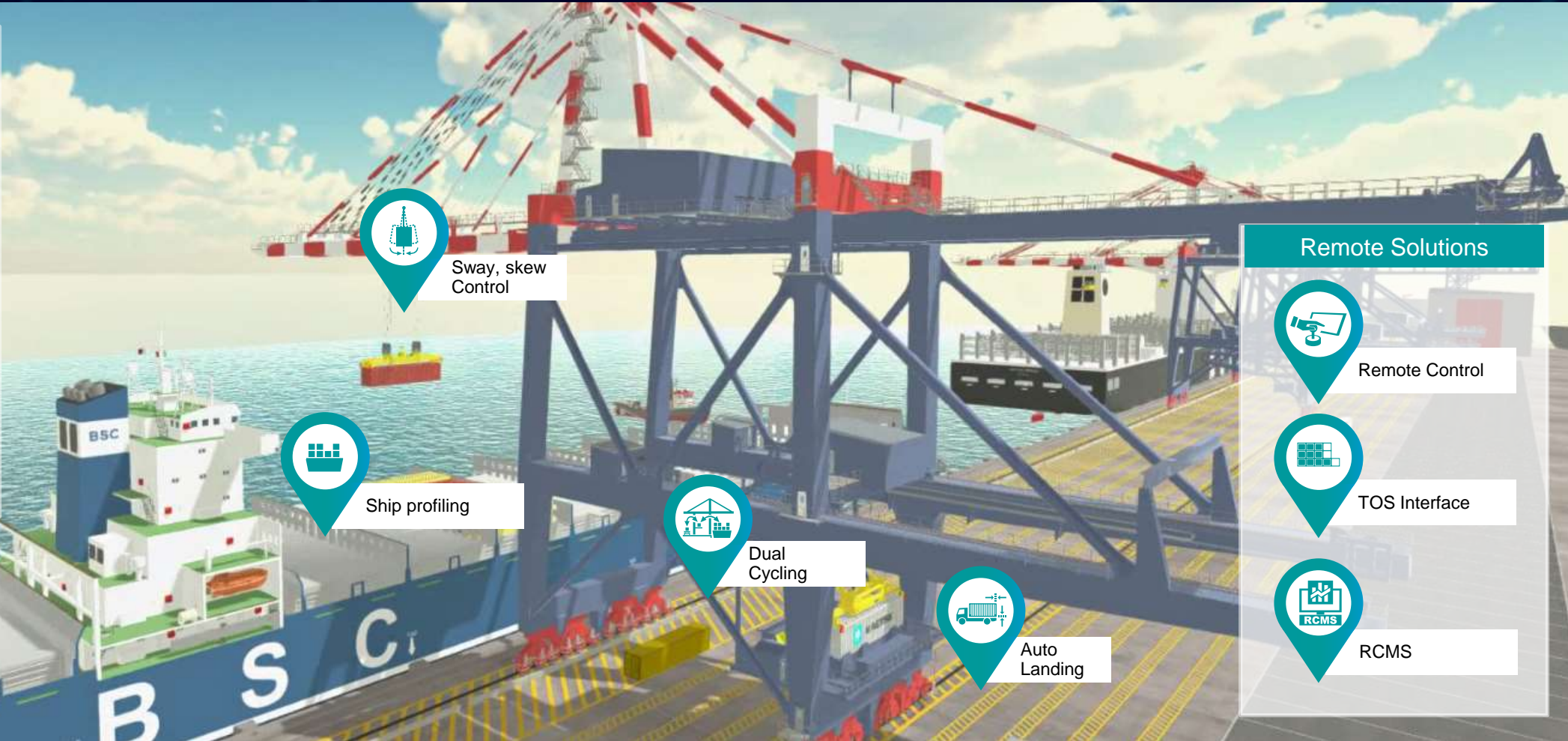
Sway, skew Control

Ship profiling

Dual Cycling

Auto Landing

Remote Solutions
- Remote Control
- TOS Interface
- RCMS

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Quay cranes automation
Productivity Increase

Combination Sway control, active skew control, truck positioning
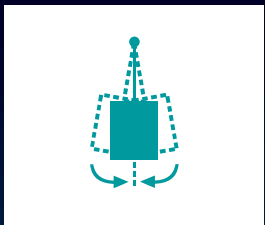
+ 1.0 mph increase*
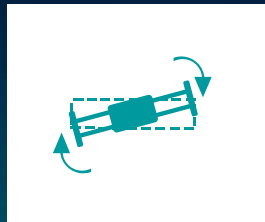
+ 2.5 mph increase*
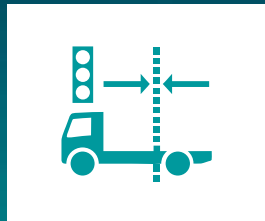
+ 1.5 mph increase*
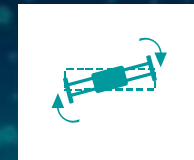
+ 5 mph increase*

* General expectation for single trolley STS
Detailed Boundary conditions to be checked

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Yard Cranes automation
ARTG – Typical Level of automation
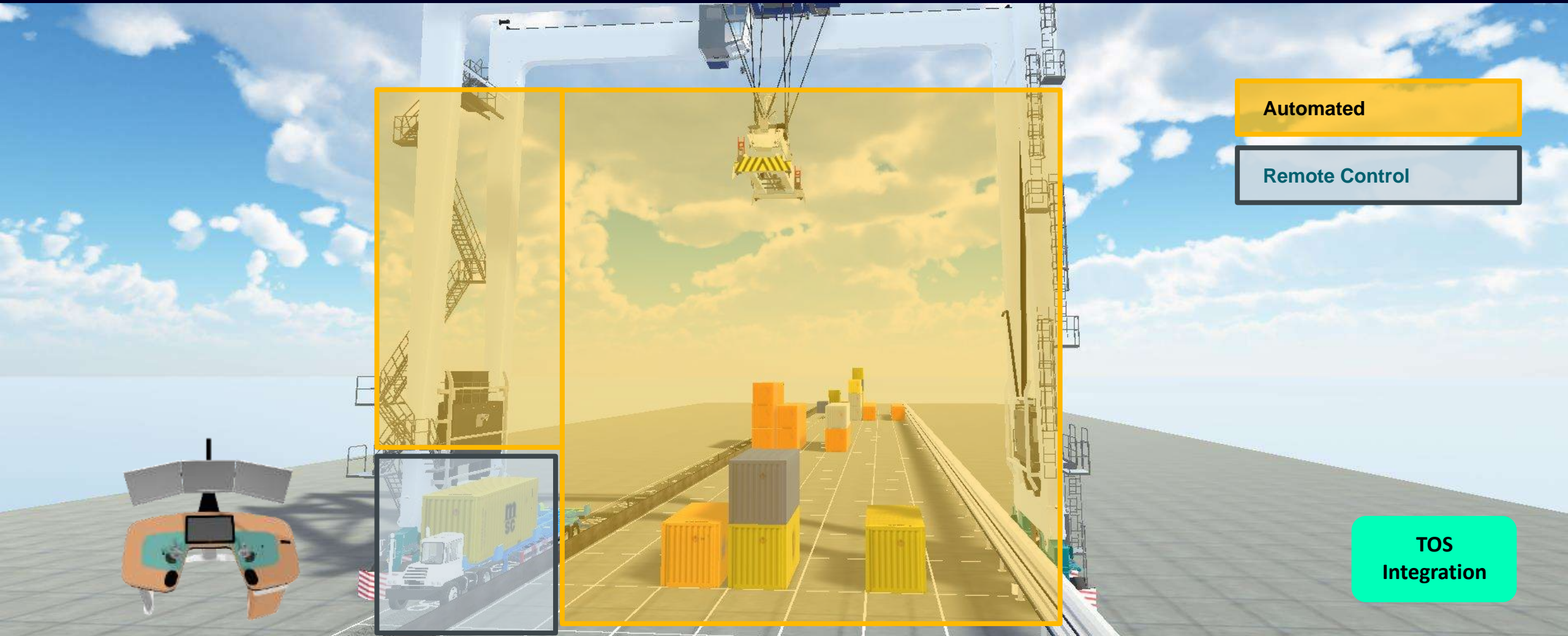
Automated

Remote Control

TOS Integration

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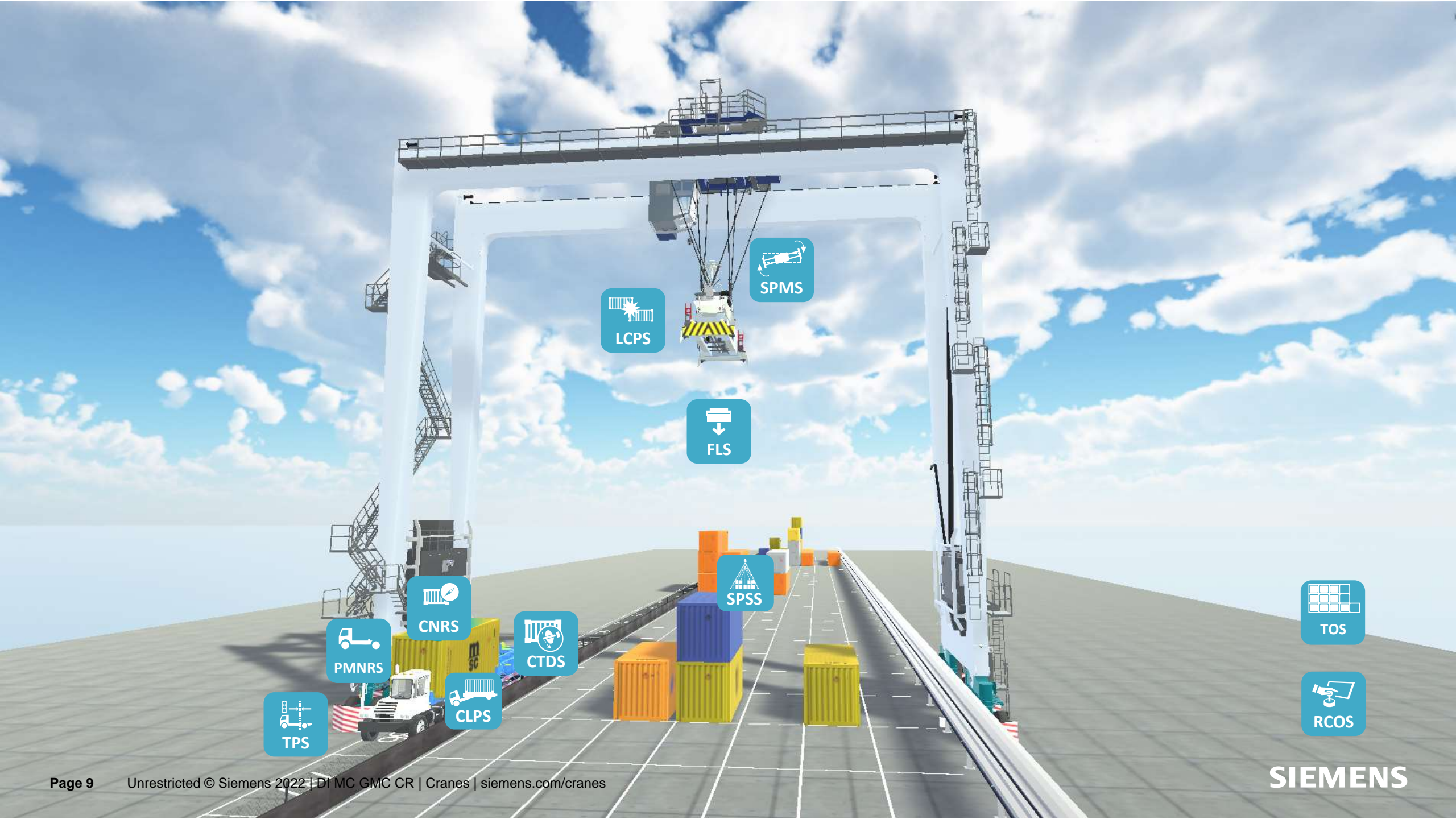
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Automation steps
ARTG

Operator/RTG

1/1
Operator Full Control
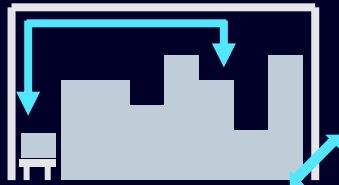
1/2
Operator with Assisted Control
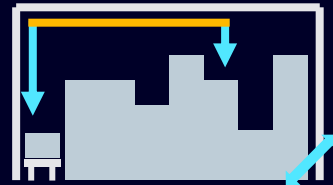
1/3
Operator for Truck Lane
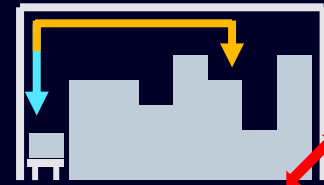
1/6
Exceptions

4. Fully Auto

CNRS   CTDS

3. Semi Auto

SPMS   FLS

PMNRS   TOS

2. Basic Auto

LCPS   SPSS   TPS

CLPS

1. Manual

RCOS
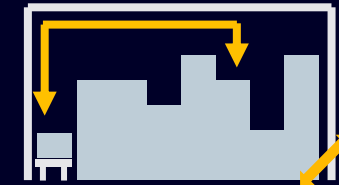
■ Operator
■ Supervised
■ Automated

Level of automation

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Transformation from Laser Sensors towards Camera Technology
→ Sensor Fusion

1 Laser Configuration

2 Mixed Configuration

3 Camera Configuration
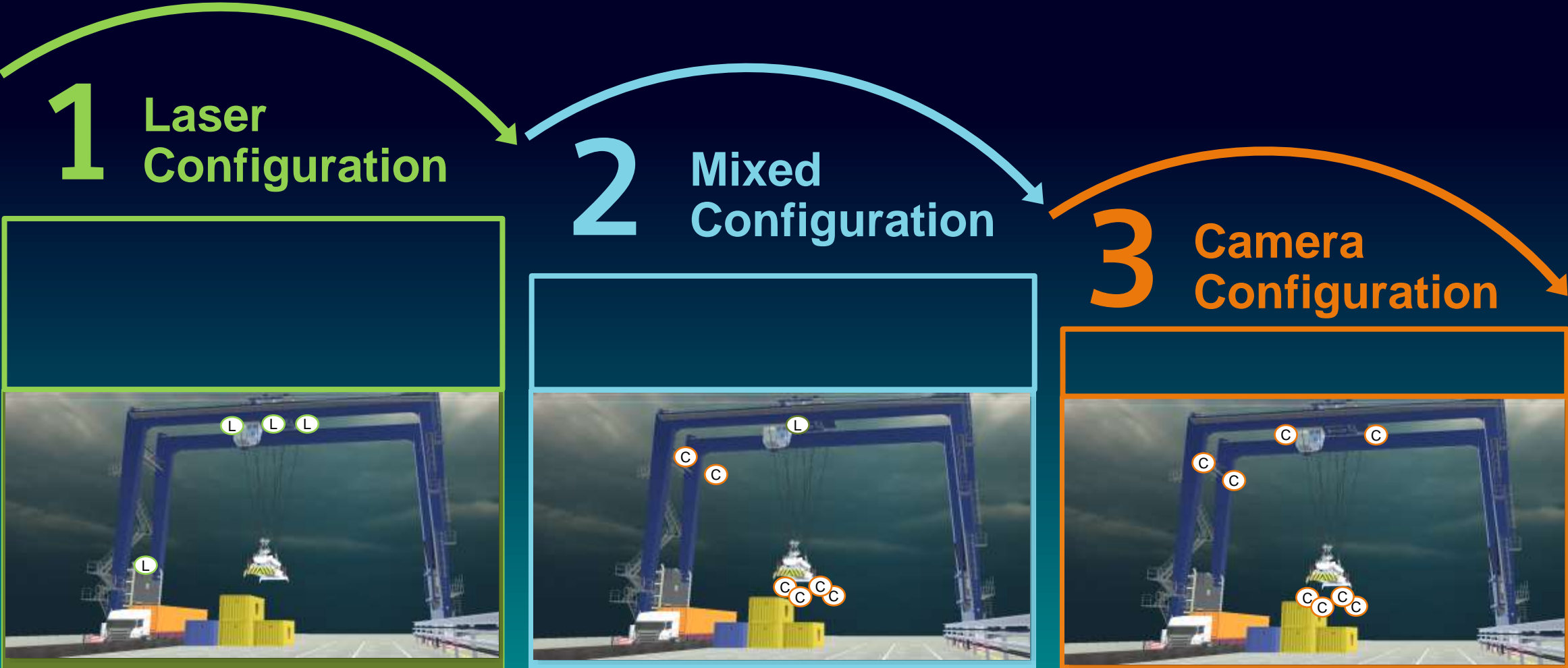
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Sensor Fusion

Combined solution
approach using
Laser + Camera
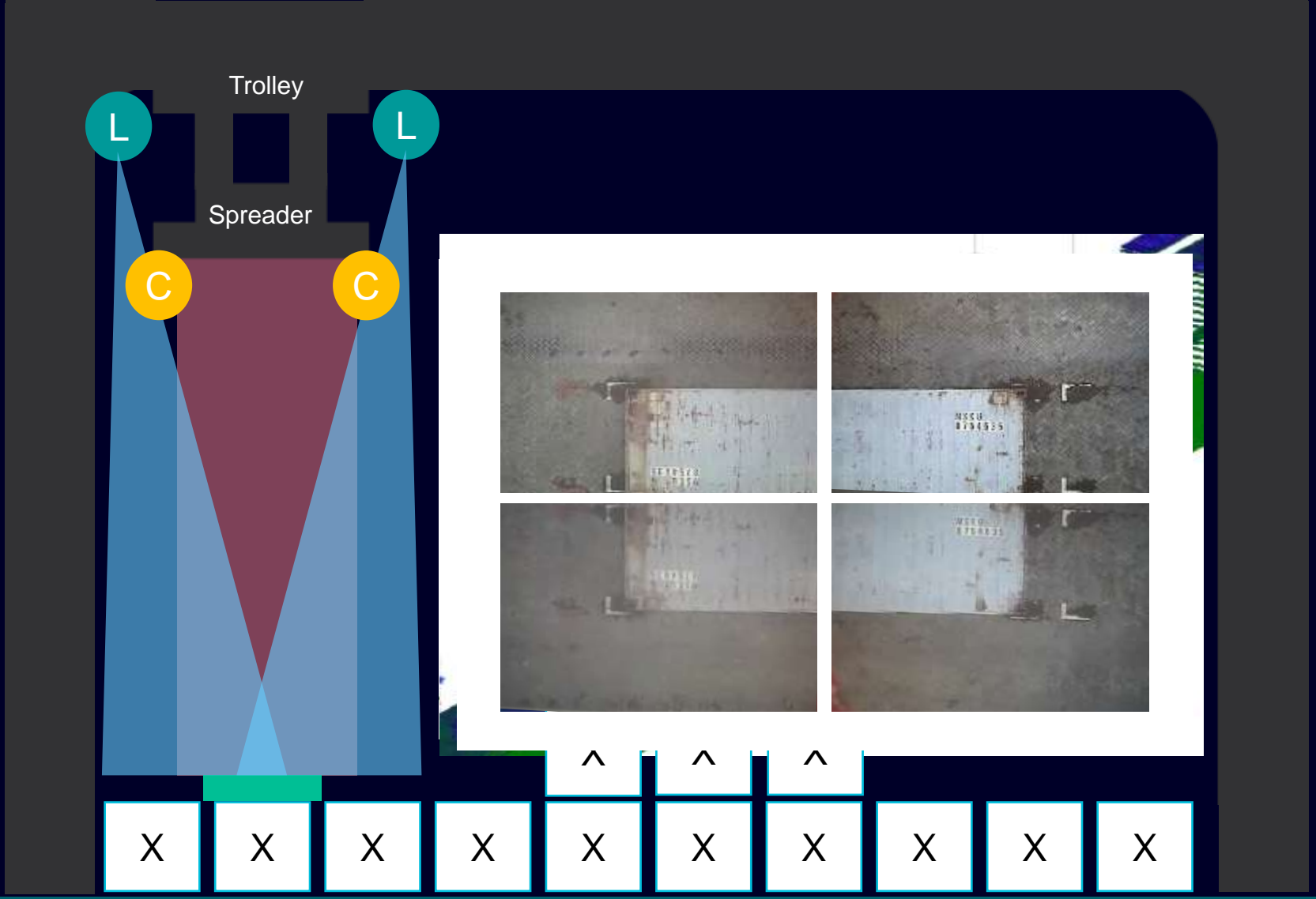
Product Development Roadmap and Focus Topics within Vision-based Solutions

Hardware

Deep Learning

Live Detection

Vision-based solutions

Network Video Recording

Detection Results

Advanced Algorithms

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Equipment Logistics System (ELS)
Integrated Solution

Software structure of a fully automated Terminal

Terminal & Block Mgmt.

ERP Layer	TOS / Software as a Service ☁
Logistics Control Layer	**ELS** Equipment Logistics System
Advanced Automation Layer	**Crane Advanced Automation Layer**

Crane & Automation Layer

Advanced Automation - Interface	
Subsystem	**LCPS** Load collision prevention / **FLS** Final landing / **TPS** Truck position / Customer specific functions
Sensor Framework API	
Sensor Framework	**Dot cloud processing, geometry detection, ...**
Sensor Hardware Adaption Layer	
Sensor Layer	camera / laser / radar

■ SIEMENS scope ■ Third-party scope

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Equipment Logistics System (ELS)
Optimize container flow throughout the terminal

Intelligent connection between TOS and equipment

- Increased terminal performance
- Manage (pool of) move instructions
- Scheduling and dispatch in ELS
- Optimal use of resources
- Reduced waiting times
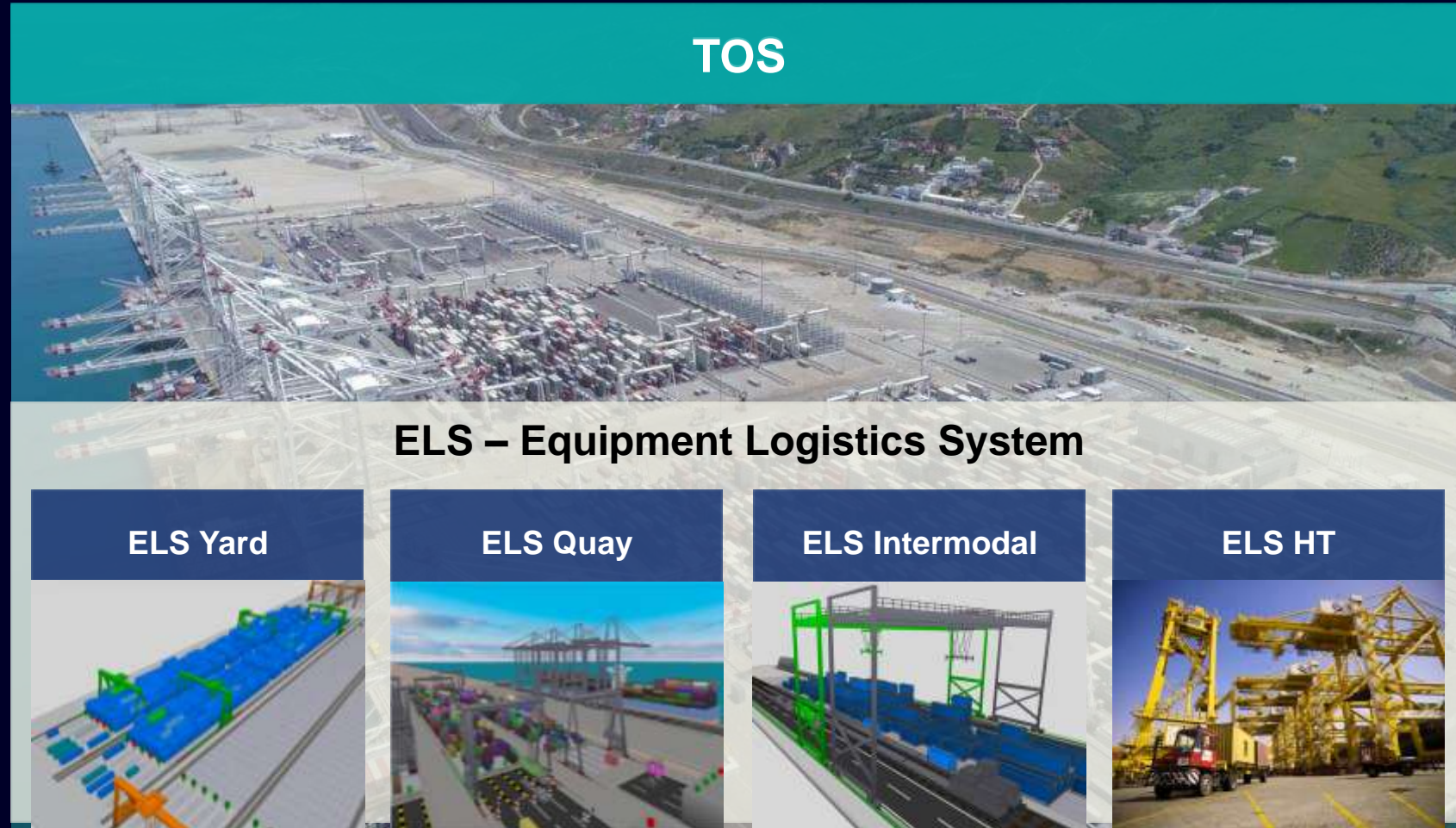- 2D/3D visualization
- Real time KPI / status Reporting
- Silent system
- Modular – Scalability for growth

TOS

ELS – Equipment Logistics System

| ELS Yard | ELS Quay | ELS Intermodal | ELS HT |

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Warehouse Management System (WMS)
Efficient transport logistics and material tracking

Customer benefits

- Increased productivity
- Increased yard storage density
- Easy tracking of material flow
- Integrated reporting and KPI
- Reduced energy consumption
- Scalable system from simple to complex applications

ERP

WMS – Warehouse Management System

| Visualization & Simulation | Efficient Operation | Material Flow Tracking | Optimize storage & dispatch |

Automation & Sensors

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Logistic simulation
Optimize container flow throughout the terminal

Design, simulate and automate the yard

- Performance simulation
- Virtual container job execution by interfacing with customer terminal operating system
- Predictive view
- Energy Management / Reduced energy consumption
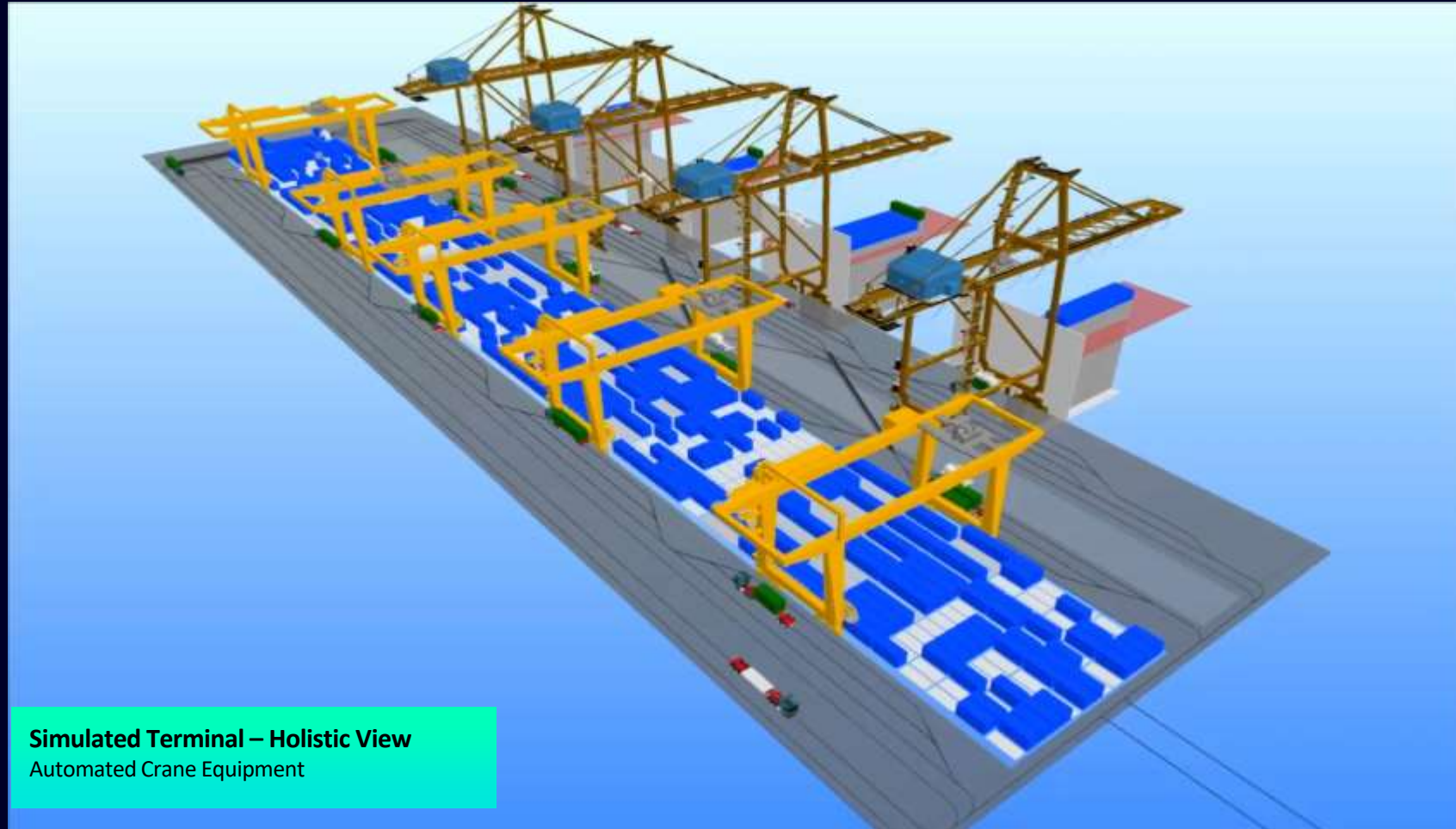
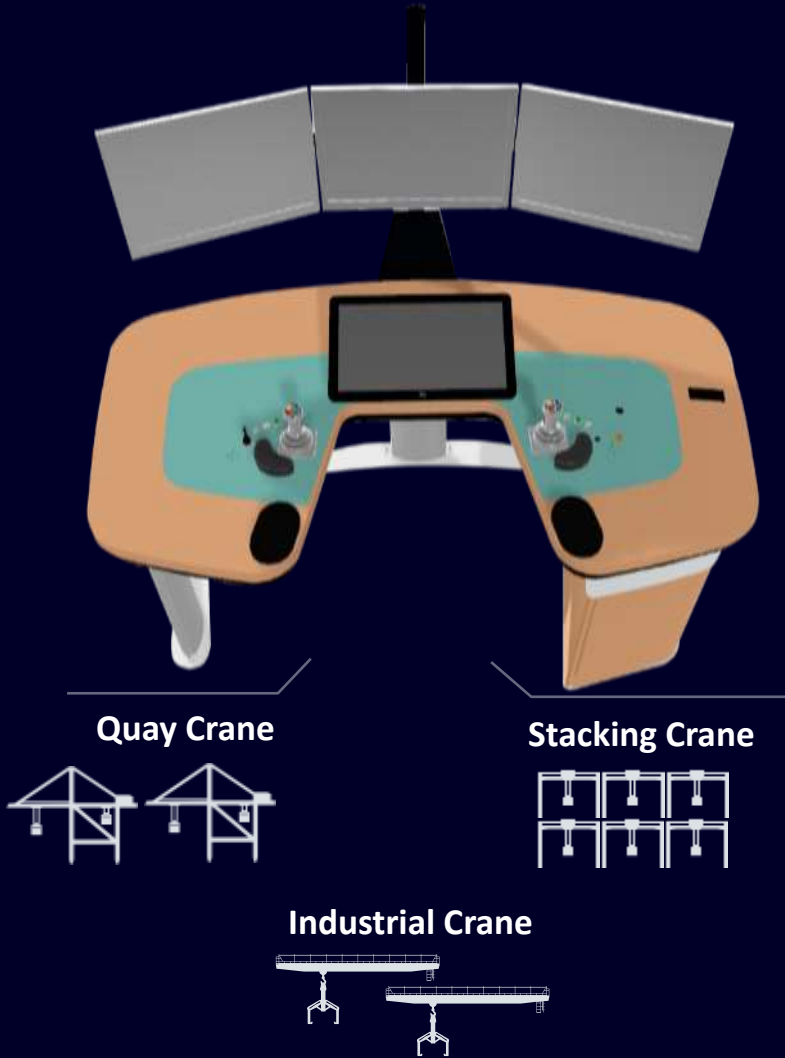**Simulated Terminal – Holistic View**
Automated Crane Equipment

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The Remote Control System (RCOS) of a Crane

Stress on human body (neck/back)

Transportation from and to cranes required

Reduced visuals due to increase of ship size

(Semi) Automation systems

"Any to any" operator connects to any crane from any desk.

"Pooling" connects crane to a free desk when assistance is needed

"Integration & Interfacing"

Quay Crane

Stacking Crane

Industrial Crane

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Safety & Security

Productivity

Usability

Ergonomics

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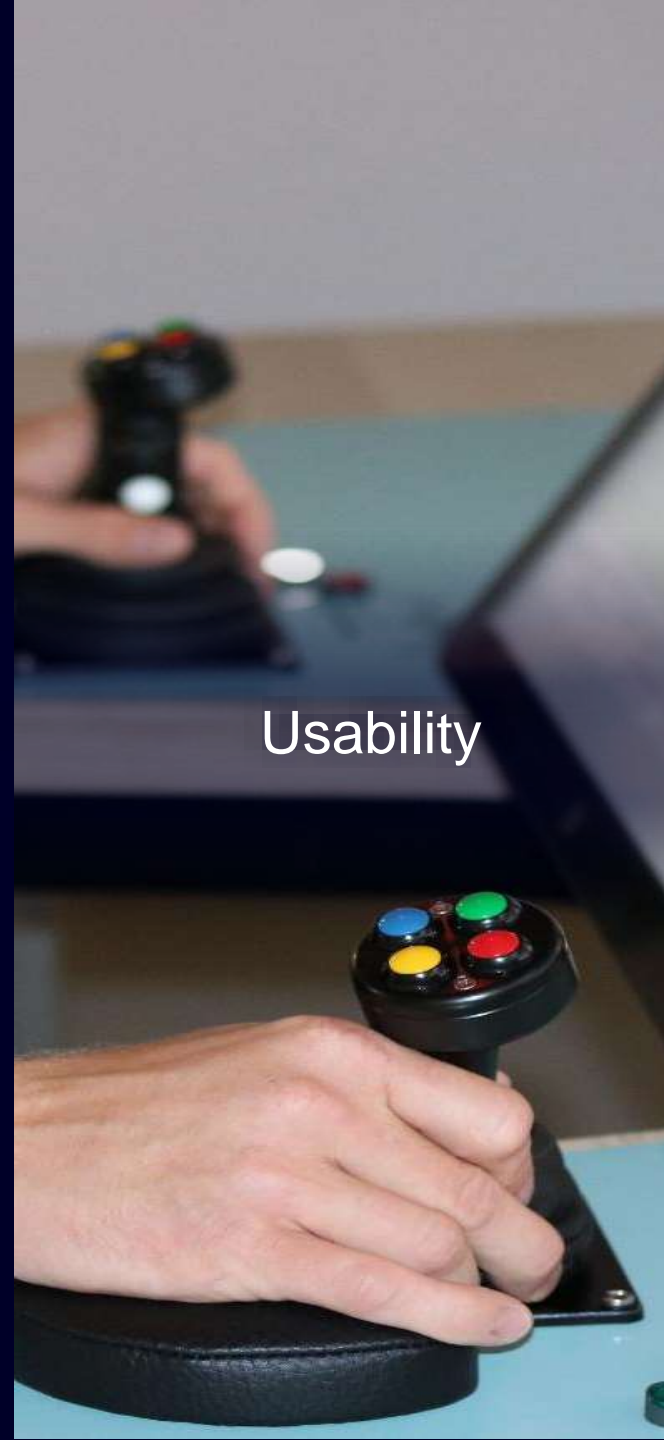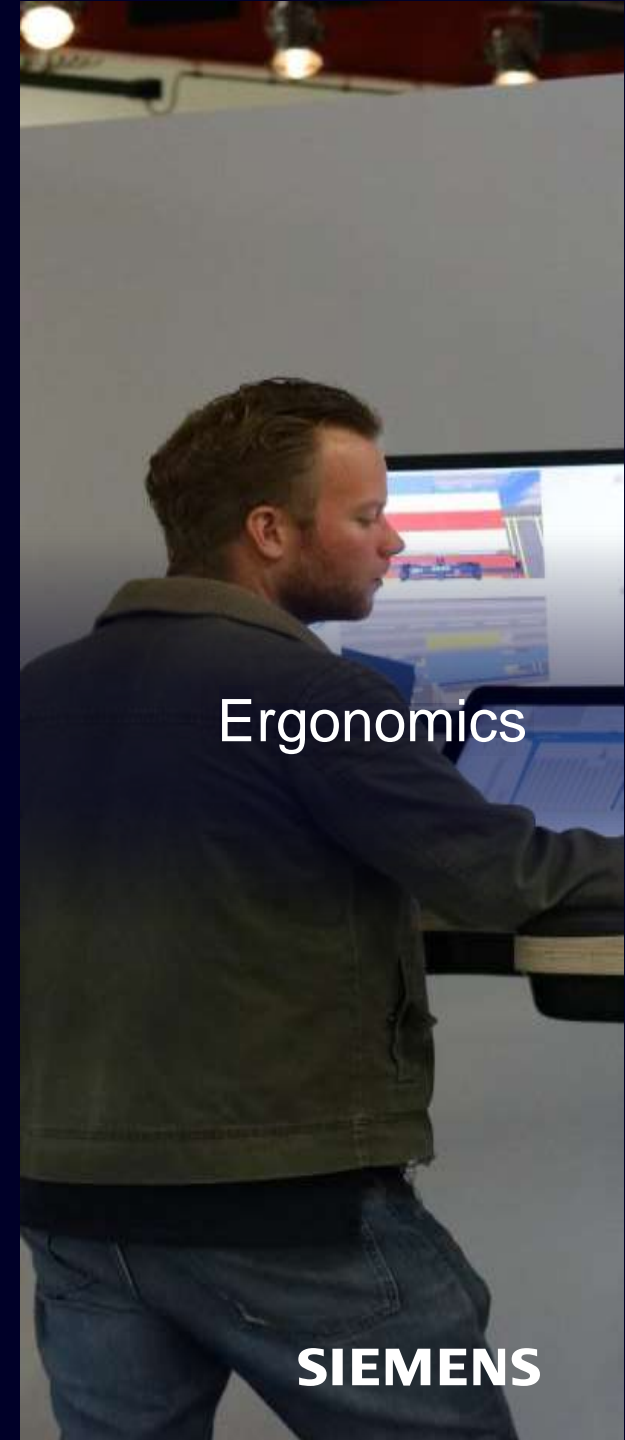
Remote Controlling Quay cranes

Features

- 1 to 1 connection
- Optimal with SIMOCRANE **Sway Control**
- High productivity

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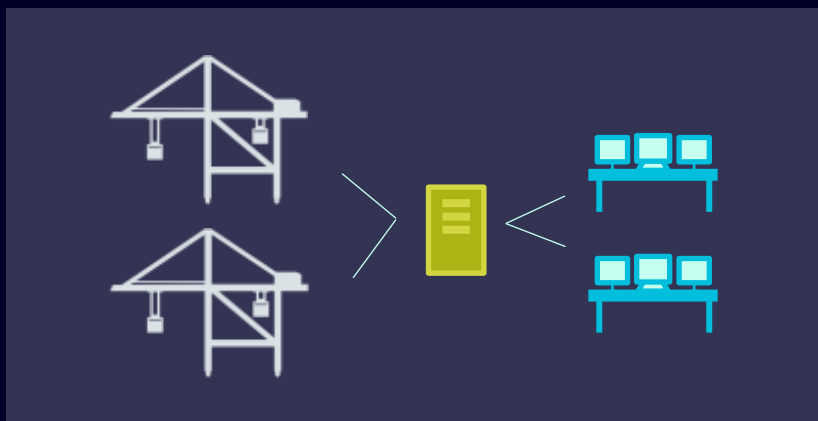
Remote Controlling Yard Cranes

Highlights

- 1 to 10 connection
- Automated Cranes
- Pooling
- Any to Any

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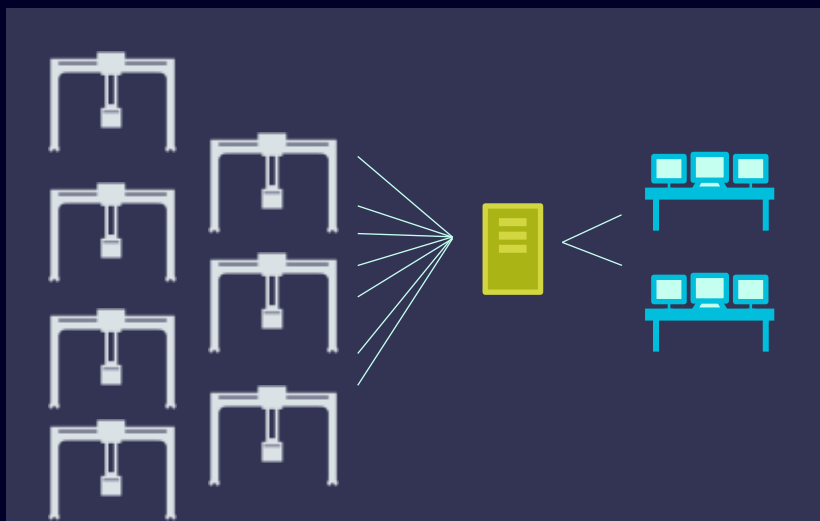
30%
Reduction of labor costs of current capacity

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Operator Training Simulator

"Spare" RCOS
- Crane remote operations
- Training
- New SW testing
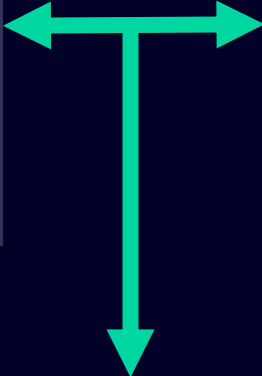
Remote operations of the real Cranes

Digital Twin for training

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Developments

Integrated developments in RCOS in 2020/2022

RCOS PLC
Modular PLC program in Crane PLC, TIA Portal

WinCC OA
Improved users experience, WinCC OA V3.17

Cameras
Vibration damper (Trolley STS)

Robustness
Integrate project learnings, extended messages, Training material

Desk design
Reduced start-up time, RCOS Compact

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Reference Projects

HPH Port of Felixstowe – 8 aRTG

HPH Rotterdam
6 RCOS STS

Evergreen Taiwan
11 STS + 40 aRMG

APMT Morocco –
48 aRMG

DPW NSIGT Mumbai
4 RCOS STS

HIT Hong Kong
12 aRMG

DPW Jeddah
10 STS + 17 aRTG

Fibria Santos
6 RCOS OHBC

SGTD Djibouti
8 ECO-RTG

PSA Singapore
56 aRMG

Patrick Australia
3 aRMG
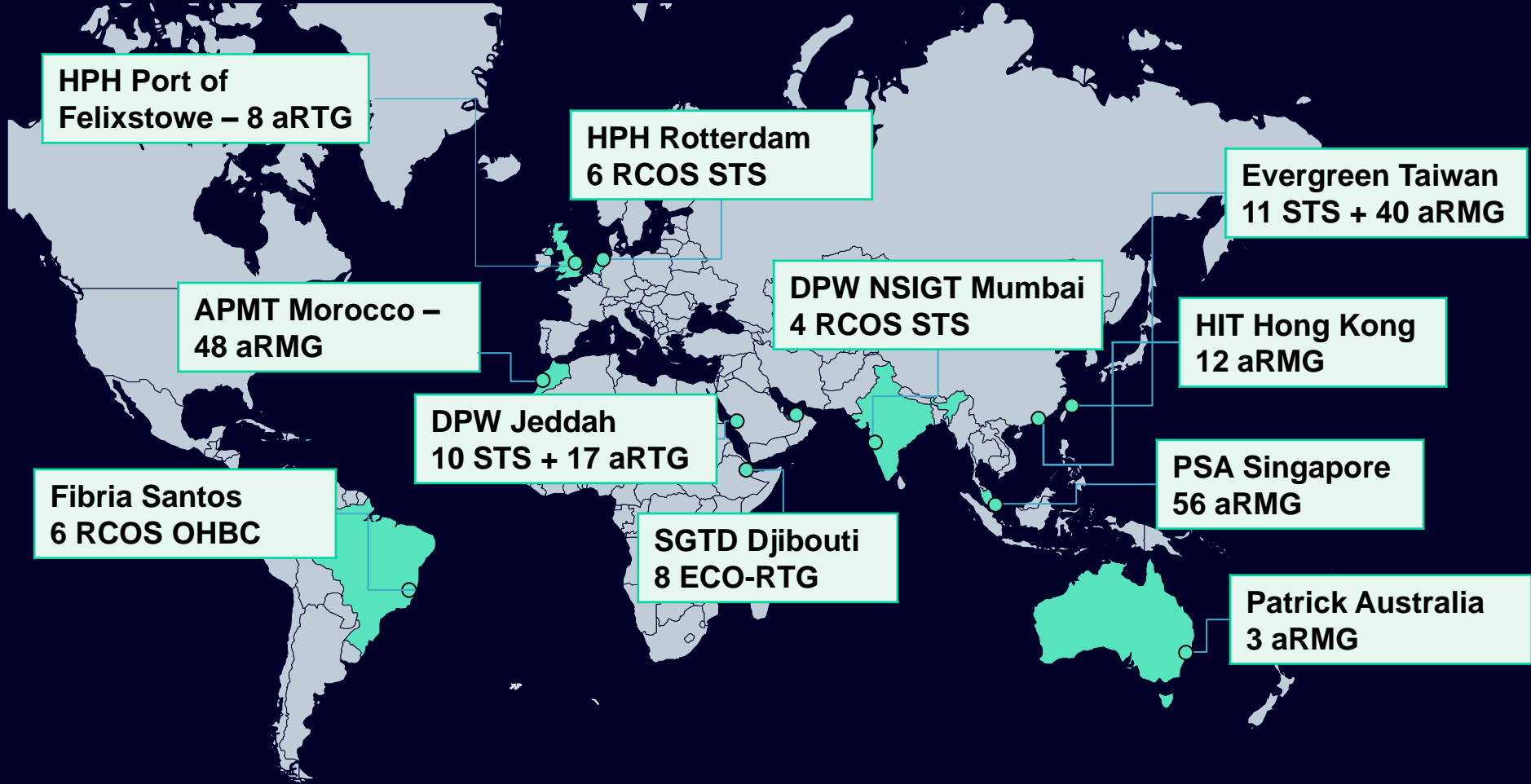
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Thank you

Go to **siemens.com/cranes** to know more about cranes solutions.

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