



# Competitive container handling using modernized cranes

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## STAY COMPETITIVE

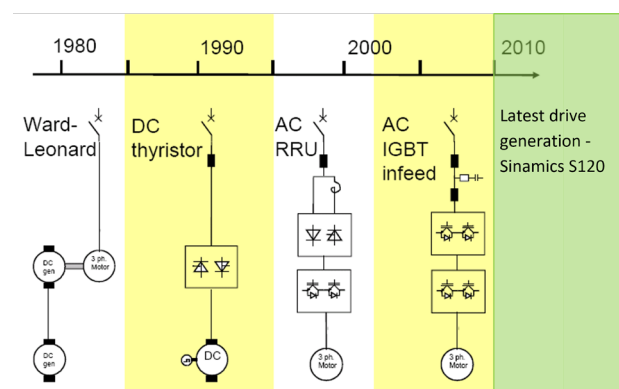
# Automation readiness with modular systems

The number of container terminals and number of cranes worldwide grow since first cranes in 60's, from pioneers work to critical infrastructure in today's globalized world. The number of cranes and their size increased dramatically since mid 90's. Today a substantial number of cranes are equipped with obsolete drive systems.

These drive systems are 10 to 30 years old and can burden daily operation with high cost of spare parts and increased breakdown frequency. Upgrading of old drive systems to the latest generation also increases automation readiness. The addition of state-of-the-art automation systems is key to stay competitive with the benefit of higher availability, reliability, productivity and safety.

## Status worldwide cranes installed base

Today there are worldwide approx. 22.000 container cranes in operation, 30% are Ship to Shore (STS), 15% Rail Mounted Gantry cranes (RMG) and 55% Rubber Tired Gantry cranes (RTG). A small portion of terminals use 1 over 3 straddle carriers and occasionally reach stackers as primary yard equipment. More than 35% of the installed cranes are 10 years – delivered cranes until 2010 - or older and the majority have legacy systems onboard, see picture 1.



Picture 1: Evolution of drive technology for cranes [1].

Cranes delivered after 2010 usually are equipped with state-of-the-art products and technology. Reputable suppliers guarantee full availability of spares 10 years after products get phased out. Which means for this part of the cranes, spares and repair will be available at least till 2031 and longer.

Nowadays, the amount of vessels with a container capacity of >20.000 TEU keeps on growing, which forces container terminals to deploy more and taller cranes with bigger outreach to handle larger call sizes within a similar time. This impacts

terminal operation and requires terminals to invest in innovation and upgrade their systems to keep cranes performance and stay competitive. As more cranes are deployed to a single vessel, the availability and reliability of all the cranes is more important than ever.

In many cases investments into new cranes are needed. However sometimes terminal operators have Cranes that can be modernized with state of the art drive technology. Also automation technology can gradually be implemented for a fraction of costs compared to purchasing new cranes.

To assure investment in modernization is worthwhile, terminal operators could check their installed cranes (STS, RTG & RMGs) on following items:

1. Do cranes still have sufficient remaining structural lifespan (5 years or longer)
2. Are cranes suitable to handle tomorrow's vessels and call sizes or are mechanical extensions needed
3. Lifespan analysis of installed drives and automation
4. Availability of a skilled team to maintain/repair crane in the next years
5. What are the possibilities to improve productivity

**Item 3** is crucial when systems are obsolete, spare parts have gotten expensive or have poor availability to secure continuous operation. When a drive system has been in operation 10 years or longer and the number of failures increase, or system components are obsolete, an upgrade could be a better option to assure crane availability, fast sourcing of spares for low prices and other benefits, see also publications [1] and [5].

We typically see STS's having not delivering their optimal cycle times. Sometimes because of waiting times during positioning or waiting for trucks/AGVs. This delays operation. Adding automation modules and systems can reduce cycle times while waiting times can be eliminated thus

improve productivity and safety [3] and [4].

Further a number of modular automation systems are presented that have been developed to extend the lifespan of the cranes and improve productivity and minimizes maintenance.

### Modernization by replacing old AC drives to SINAMICS



Picture 2: Replacement of Masterdrives by SINAMICS S120 chassis

Modernization assures higher reliability and availability of cranes and give you the following benefits:

- Excellent spare parts availability
- Good availability of support for commissioning, repairs and trouble shooting
- Engineers with state-of-the-art knowledge and training facilities are widespread around the globe.
- Step by step gradual modernization as key approach. Parts from old SIMOVERT Masterdrives system can be harvested and made available as spare part for other cranes or terminals.

### Extracting data from equipment

SIMOCRANE Crane Management Systems (CMS) are the main data collection points to different PLCs and other connected systems on the crane. For multi-distributed systems, with many cranes, the system architecture using SIMOCRANE CMS and Remote Crane Management System - RCMS - can be used to connect all CMS stations and make use of long-term archiving systems like in WinCC. With the connection of all CMS systems to the



RCMS server, all data can be archived and analyzed in a central database.



Picture 3: RCMS provides centralized data storage from any CMS station

Main benefits are:

- Fast trouble shooting and fault diagnostics
- Condition monitoring
- Maintenance assistance and efficiency
- Remote services and online help
- Visualization of crane parts
- Operation variables recording (replay function)
- Standard productivity reporting KPI's
- Higher availability in operation.

#### **Faster offloading and eliminating of waiting times through automatic truck positioning**

Worldwide many terminals are utilizing terminal trucks as primary mean for horizontal transport. Investments in TPS typically offer up to 10% productivity improvement on the STS. Experience shows that installation of SIMOCRANE Truck Positioning System (TPS) results in faster and more consistent positioning of trucks under the quay cranes, eliminating possible waiting times.

The TPS system supports the truck driver during positioning with the aid of simple control signals. One SIMOCRANE Truck Positioning System covers two adjacent lanes at the same time (tandem mode).

- Improve your STS productivity up to 10%

- Increase safety to personnel and machines.
- Checkers are no longer necessary
- Save time when positioning the transport vehicles
- Accurate target position depending on the mode of operation, load and target vehicle
- Increase the degree of crane automation, and enhance productivity, when SIMOCRANE TPS is combined with other automation modules like SIMOCRANE Sway Control and skew control systems.

#### **From control to supervision of cranes**

SIMOCRANE Remote Control System (RCOS) delivers a complete end-to-end crane control solution. The remote control station can be situated anywhere on the terminal when associated with a reliable and low latency network connection.



Picture 4: RCOS for STS, RTGs and RMGs - automatic moves

SIMOCRANE RCOS assists operators to carry out their work assignments by presentation of all task-dependent information on a human-machine interface which is tailored to the cognitive and physical capabilities of a human operator.

- Systems available for 24/7 operation
- Productivity is the same or even better compared to control from the cabin
- Remote operators can be trained in a simulator and need less time to learn



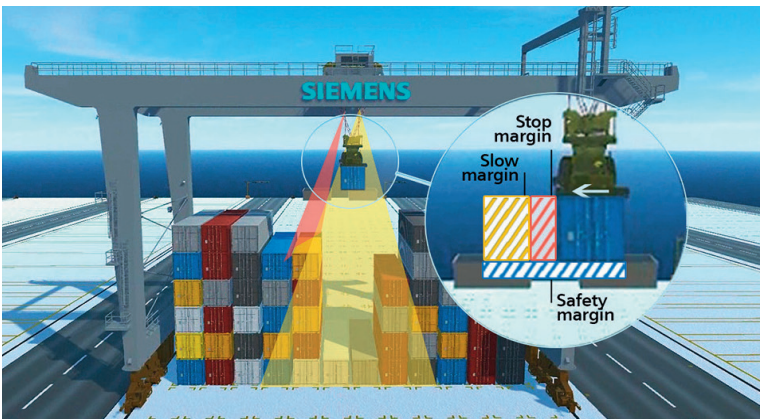
Picture 5: RCOS ergonomic desk – customer tailed

- Multiple cranes can be controlled from one remote operations center
- RCOS is suitable for remote operation of STS, RTG, RMG and OHBC in industry.

#### Reduce insurance claims and maximize safety

SIMOCRANE Load Collision Prevention System (LCPS) is a stand-alone system which can be interfaced to new or existing crane control systems via hard-wired and with PROFIBUS/ PROFINET and/or industrial ETHERNET connections.

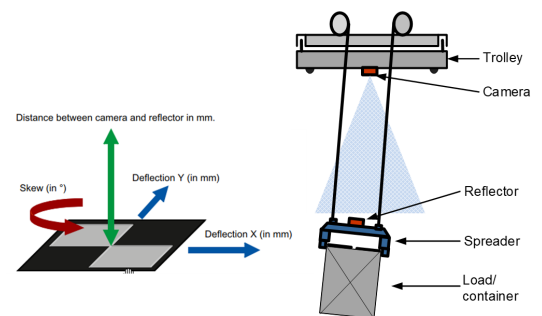
SIMOCRANE LCPS for stacking cranes is a system that supports the crane driver to prevent collisions of the loaded or unloaded spreader with stacked



Picture 6: LCPS - safe operation of manual and automated RTGs and RMGs

containers. Avoid crane accidents and lower insurance costs. More information about accidents at terminals is given in TT Club publication, see reference [2].

#### Efficient charging and discharging cycles



Picture 7: Sway control for harbor and industry cranes

SIMOCRANE Sway Control ensures that headblock/spreader sway and skew are eliminated so that container moves can be performed quickly, without danger and damage to the transported goods.

SIMOCRANE Sway Control also offers the following benefits:

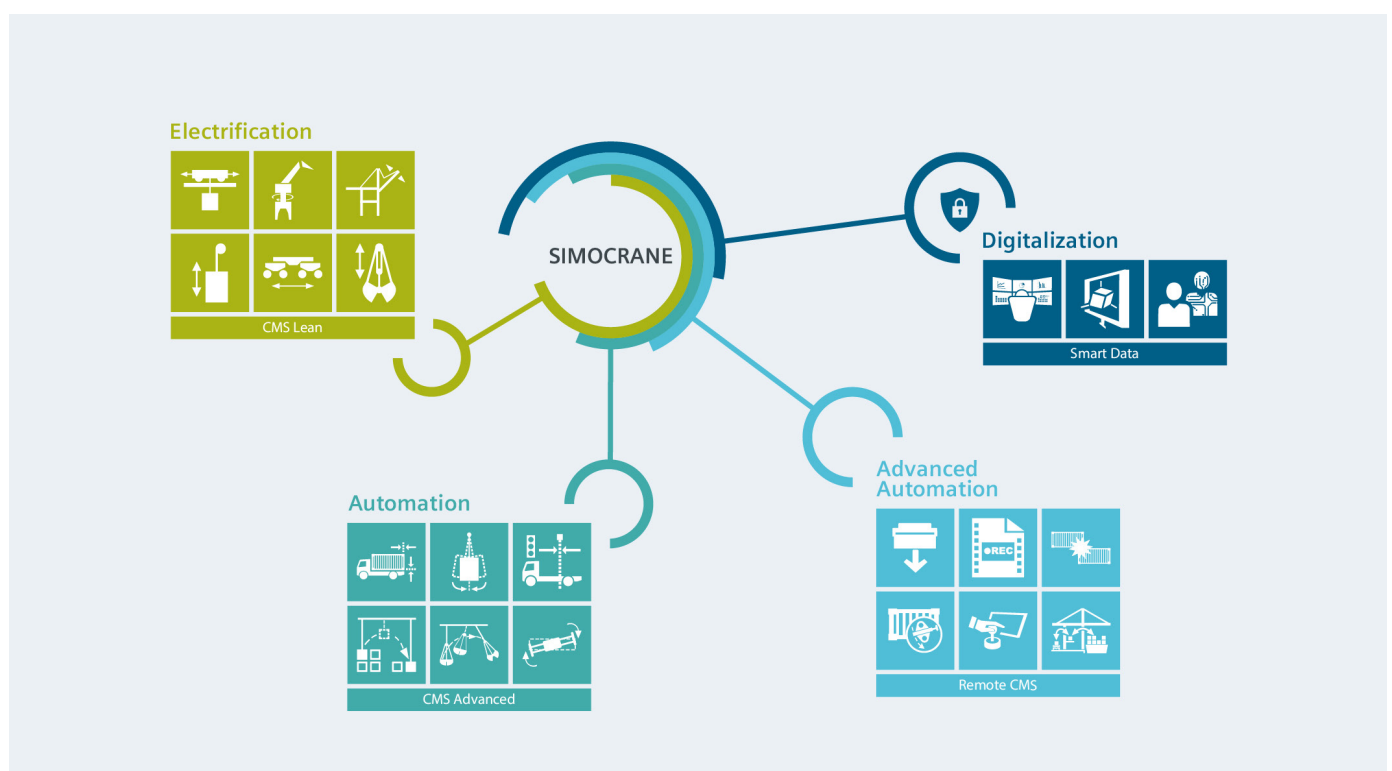
- Efficient dual cycling feature for loading and unloading in the same cycle
- Increase productivity of the crane system by a reliable load control
- Reduce damage to gearboxes and cables for hoist and trolley due to controlled torque switching times
- Prevent accidents
- Reduce stress on the construction extends crane life
- Continuous load damping no longer depends on crane driver skills
- Easy operation for crane drivers regardless of their experience
- Reduce physical stress of crane drivers – less crane drive fatigue.



### References:

- [1] Gerhard Fischer, Crane Fleet Management – Electrical Standardization, 2nd Southern Asia Ports, Logistics and Shipping Conference, Mumbai 2007
- [2] Laurence Jones, TT Club identifies where to focus on loss prevention, PORT TECHNOLOGY INTERNATIONAL
- [3] McKinsey & Company, The future of automated ports, November 2018
- [4] PEMA Information Paper, Automating Yard Operation in Brownfield Container Terminals: Infrastructure – 2019
- [5] Stuart Atkin, Requirements for the Modernization of Electrical Crane Controls - 2012

More automation systems are available to improve your operation.  
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