Künz GmbH

Automation in maned environment

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KUENZ RMG CRANES

AGENDA

- Introduction
- Automation in the Port environment
- Automation and human interaction
- Technical approach
- Terminal organization and regulation
- Legal aspect

KUENZ INTRODUCTION

CONTAINER CRANES

Intermodal operation

Railway - Road

Intermodal operation

River - Railway - Road

Automated Container Cranes

Yard Operation

Reliability and Availability

Kuenz Cranes

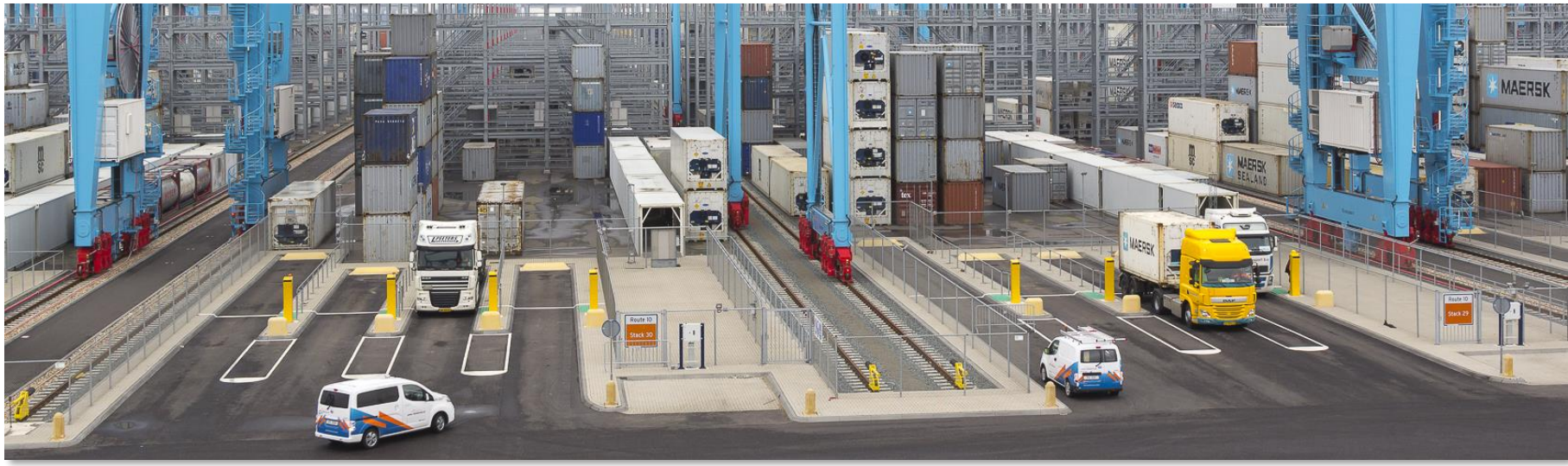
AUTOMATION IN THE PORT ENVIRONMENT

PORTS / STATE OF THE ART TECHNOLOGY

Automated Sea-Terminal APMT MVII

AUTOMATION IN THE PORT ENVIRONMENT

PORTS / INTERACTION AND TRUCKLOADING



In Ports, automated areas are segregated from manned areas by fences and controlled access to the automated equipment.

Personnel working underneath the crane will always be handled as an exception with regards to automation.

AUTOMATION IN THE INTERMODAL WORLD

INTERMODAL / MANNED ENVIRONMENT

AUTOMATION AND OBSTACLE DETECTION

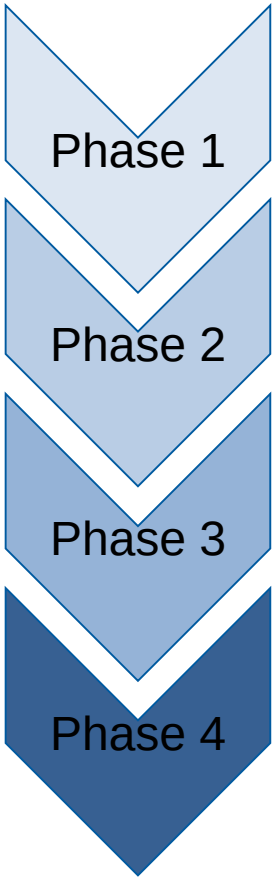
SURROUNDING CONDITIONS IN INTERMODAL AUTOMATION

- **Contrary to an ASC environment, fencing off the area is not usually an option**
- **Personnel on the ground throughout the terminal:**
  - IBC handling
  - External trucker and hostler truck operator
- **Train spotting and verification**
- **Many different kinds of rail cars in use**
- **Many different shapes of chassis in use**
- **Mixed TOFC and Twist lock operation**
- **At the present time, “people detection” technology has not been approved according to EN13849 machine safety directive, and SIL is not available.**

AUTOMATION AND OBSTACLE DETECTION

AUTOMATION IN PHASES

- **Phase 1: Remote control desk**
  - Cabin in the office
- **Phase 2: People and Equipment recognition**
- **Phase 3: Automation Part 1**
  - Automating Stack
  - Automated Container pick from train and chassis
- **Phase 4: Automation Part 2**
  - Automated set down of containers onto trains
  - Automated set down of containers onto chassis

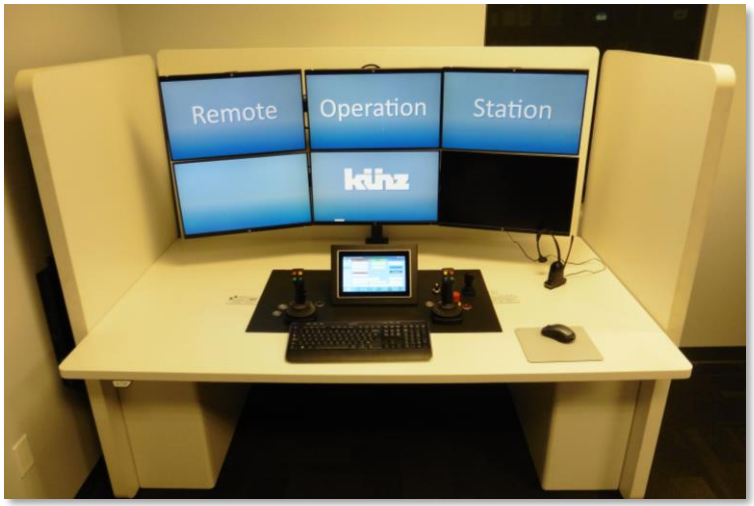


Phase 1

AUTOMATION AND OBSTACLE DETECTION

PHASE 1 – REMOTE OPERATION STATION

Is Substituting the operators view out of the Cab by means of cameras sufficient to ensure a safe operation?



- Placing the operator in an office environment
- One operator interacts with multiple cranes
- Safe access to workplace
- Reduced time for shift change
- More freedom for the operator to organize his work day

Phase 2

PEOPLE AND EQUIPMENT

OTHER EQUIPMENT IN SAME OPERATING SPACE

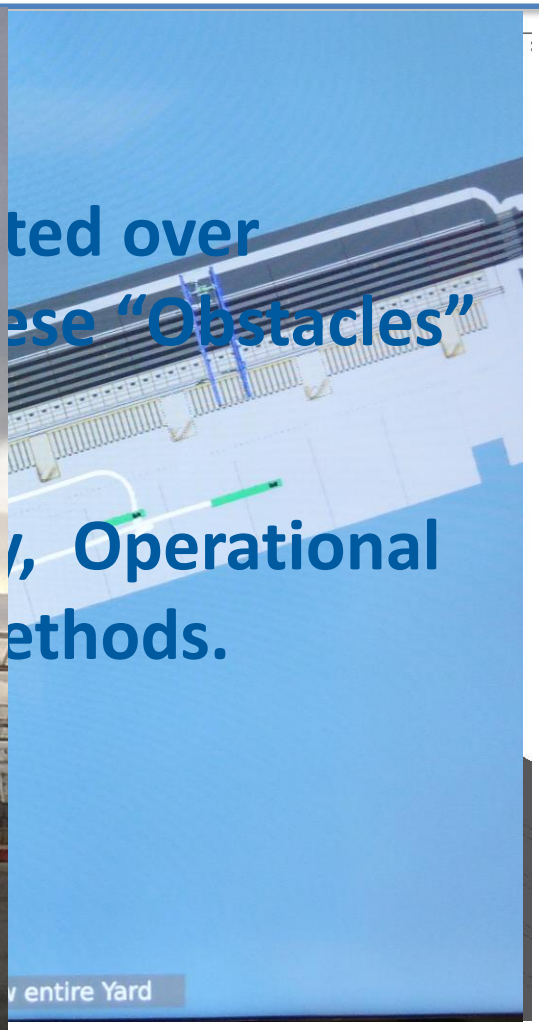
In the Intermodal operation, a variety of ground traffic is required.

- Grunts for IBC handling
- Spotter for train verification
- Rail car inspection
- Hostler trucks
- Outside Trucker
- Reach stacker, RTG, Shuttle carrier, etc.

Phase 2

AUTOMATION AND OBSTACLE DETECTION

PHASE 2 – PEOPLE AND EQUIPMENT ON THE GROUND



Phase 2

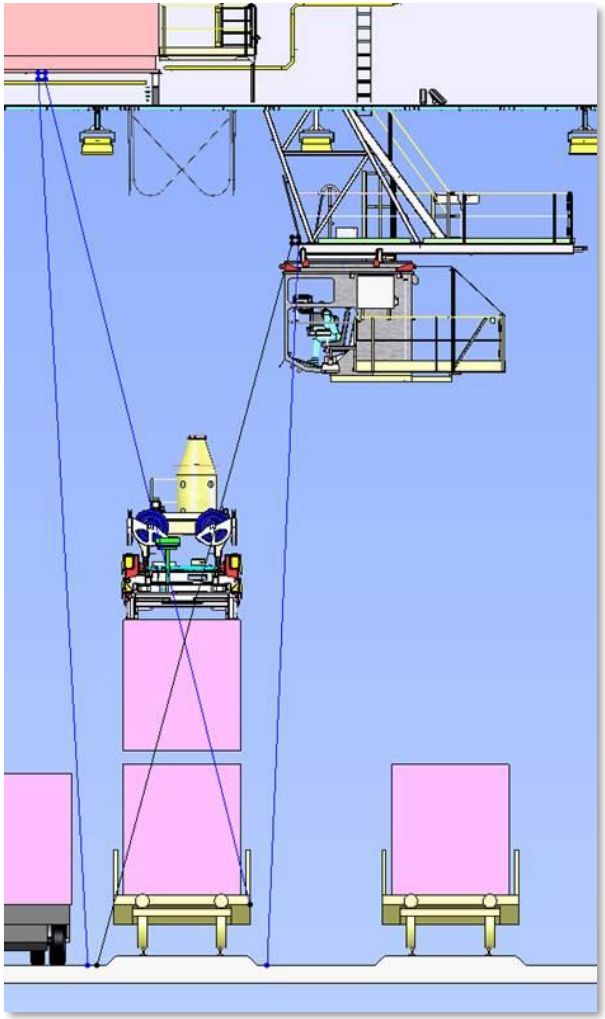
YARD CONTROLER

COORDINATING CRANE MOVEMENTS TO AVOID OBSTACLES

Phase 3

UNLOADING TRAINS AND STACK HANDLING

PHASE 3 – ADDITIONAL FUNCTIONS



- Picking Containers from rail cars and trucks, as well as handling the container stack, is proven technology used on ASC's.
- Avoidance of Picking Two Containers
- Door direction

Rail Car Operations

- Same automation equipment is used as in the stacking area
- Target position on the rail car will be measured by the LCPS (Twistlock detection)
- IBC´s between Containers need to be opened manually

Phase 4

LOADING RAIL CARS AND CHASSIS

PHASE 4 – RAIL CAR OPERATIONS

Rail Car Operations

- Search for twistlock pins (?)in bottom tier of railcar to land the container
- Side guide recognition

Phase 4

LOADING RAIL CARS AND CHASSIS

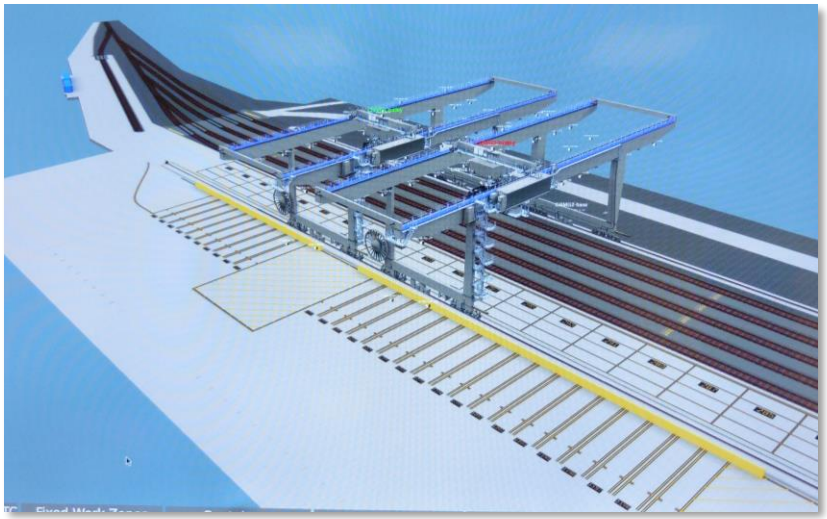
SAFETY SYSTEMS – TRUCK ANTI-LIFT SYSTEM

- Additional 2D laser scanner mounted on the sill beam of the cranes

Phase 4

LOADING RAIL CARS AND CHASSIS

TRUCK LOADING AND SAFEGUARDING TRUCK DRIVERS



Sea Terminal with few truck lanes – Kiosks are used

Intermodal Terminal with many parking slot's. Kiosks may not be a viable solution to safeguard the truck driver?

LEGAL ASPECT

- In a standard crane operation where the operator is on the crane, the crane manufacturer must ensure the crane system integrity and safety.
- Avoidance of moving a load (Container) above personnel must be obeyed.
  This is monitored either by technology or is set by operational rules (e.g. crane operator).
- At an automated or remote-controlled crane operation with personnel on the ground, the responsibility is no longer limited to equipment safety.
  In addition to safe equipment, operational rules should be implemented. Therefore, the terminal operator directs many tasks to ensure safe operation.
- Common few on equipment safety and operational regulation needs to be considered in the over all risk assessment.
- Complex analysis to determine responsibility in case of an accident
- In the event of an incident, who is held responsible? (financial more viable party)