NEW TECHNOLOGY INITIATIVES IN TERMINAL OPERATION

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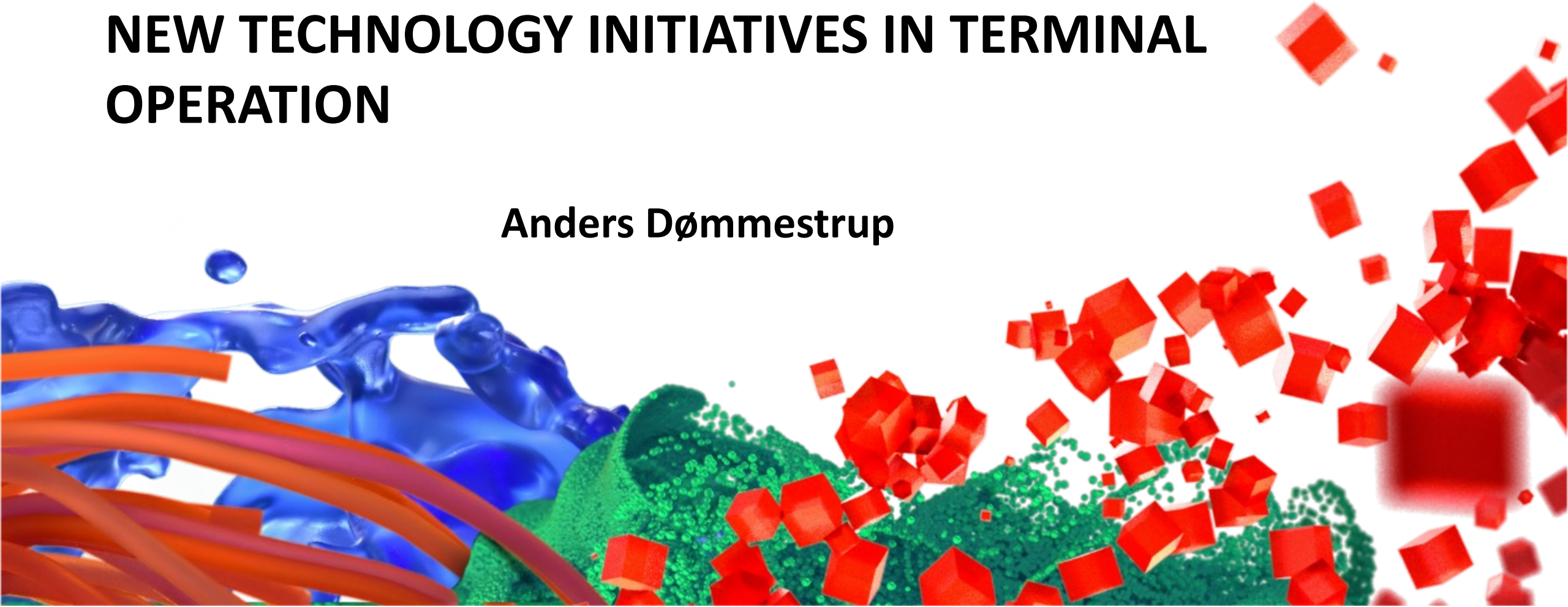


CHALLENGES FACING PORTS

Upsizing ship

- ULCS density not in balance with yard density
- Need to optimize the terminal efficiency (Productivity, Efficiency for Yard operation)

Enhanced safety regulations

- Serious Accident Punishment Act and Port Safety Special Act
- A new perspective on safety management (Systemizing safety accident prevention)

Change port environment

- Labor shortage & Declining birthrate
- Enforcement of environmental legislation for shipping and ports

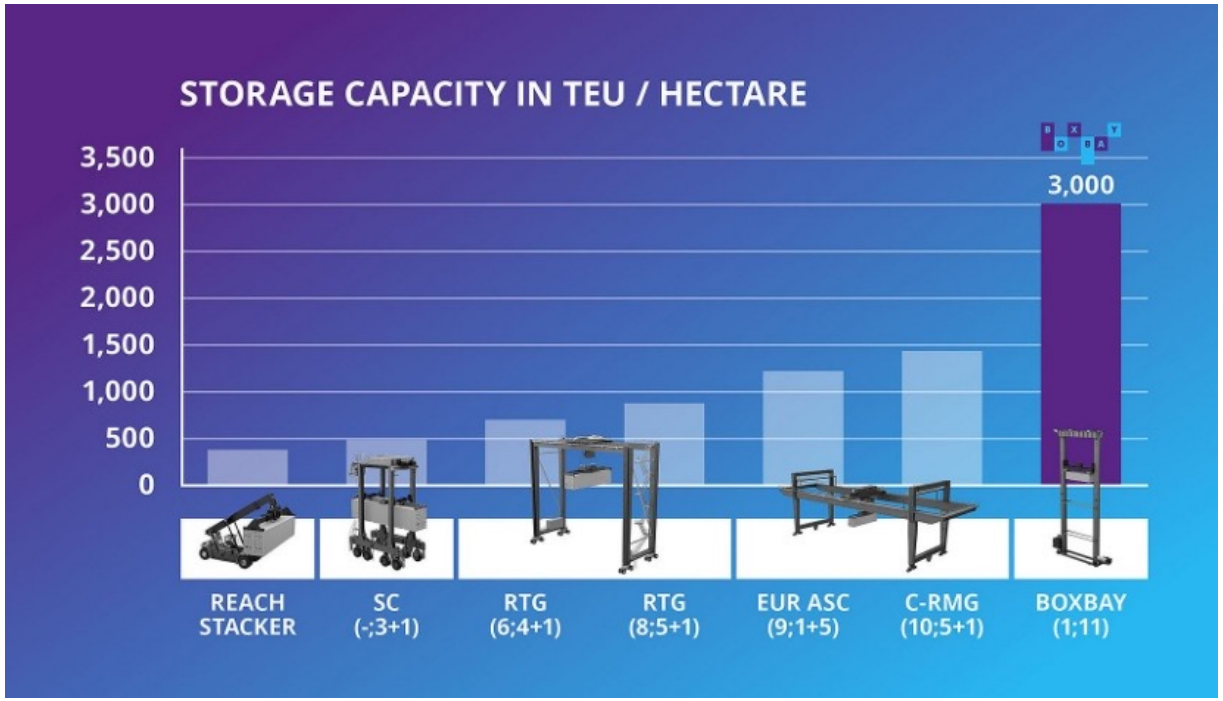
Innovation, Automation, Optimization

TRANSFORMING TO A SMART AND AUTOMATED PORT

1. BOX-BAY

High Bay storage

- Container can be stacked up to 11 high and individual rack
- Use only one third of the footprint of conventional storage systems for an equivalent number of containers
- Direct access to each container



Structure of High Bay storage

HBS rack structure

Stacker crane

Cross pallet conveyor loops

Truck crane interface

Top Grid Interface

Reduce unproductive moves, improve carbon footprint and safety

Automation

- Highly reliable and performant total automation system
- Warehouse management system
- Works with any TOS

Effciency

- Minimal terminal footprint
- Direct container access at any time
- Elimination of all unproductive moves (no shuffling)
- 100 % utilization is possible

Safety, Environmental

- Powered by a solar pannel roof, reducing carbon emission
- Lack of light pollution
- Few pedestrians in Box-bay (engineer)
- Preventing container topple down

2. EMR CONVERSION

Inefficiencies & safety risk at Container EMR workplace

Inefficient space

A lot of space is required to run a repair shop on ground.

Labour-intensive

Container repairing is highly a labour-intensive work.

There is a risk of human error.

inefficiency

Handled by empty – There are challenges with flexible operation for fast containers turnover.

In general, containers should wait until all containers in their row are repaired.

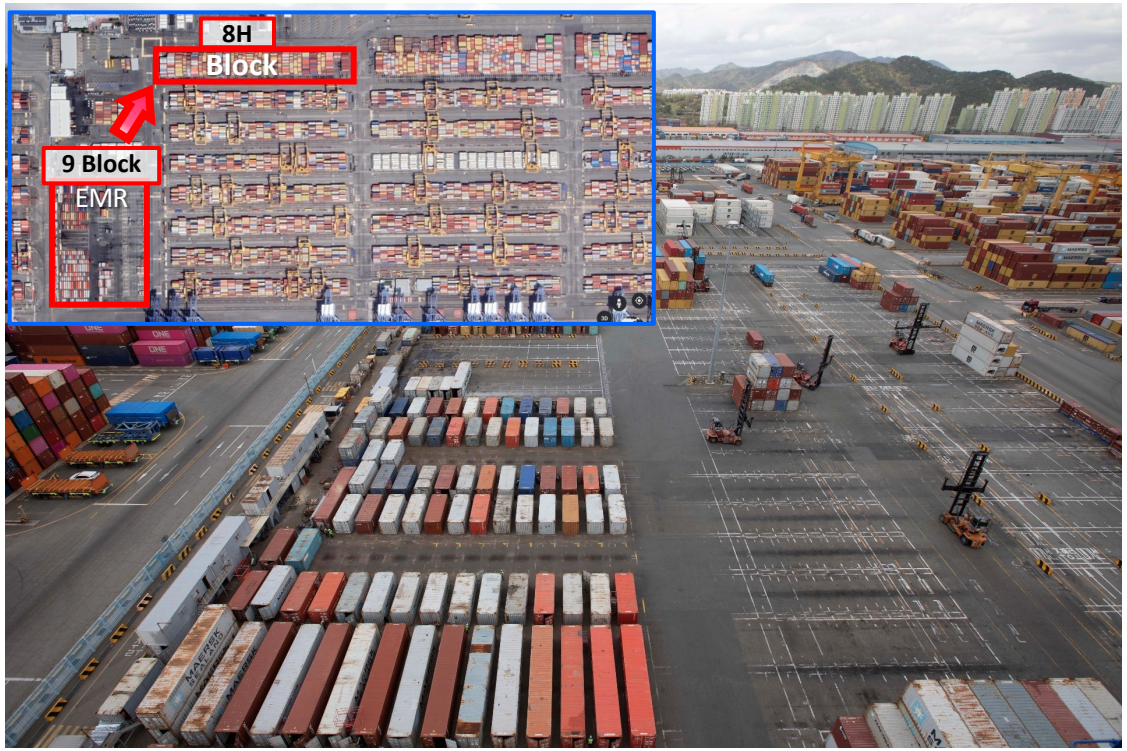
Safety Risk

Repair shops have equipment and workers working in the same space, creating a risk of collision.

Improve safety and efficiency in traditional manual labour environment

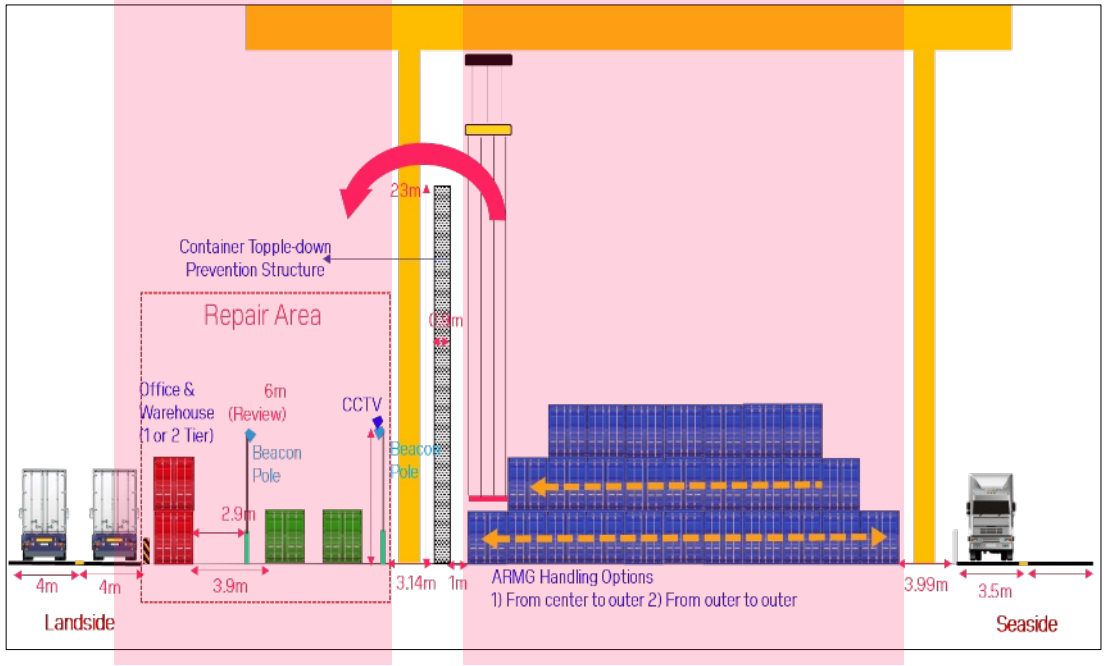
- Convert from ECH-based EMR operations to automated RMGCs with enhanced safety measures
- Ensure to improve safety and efficiency in EMR workplace adding technology for safety

Current



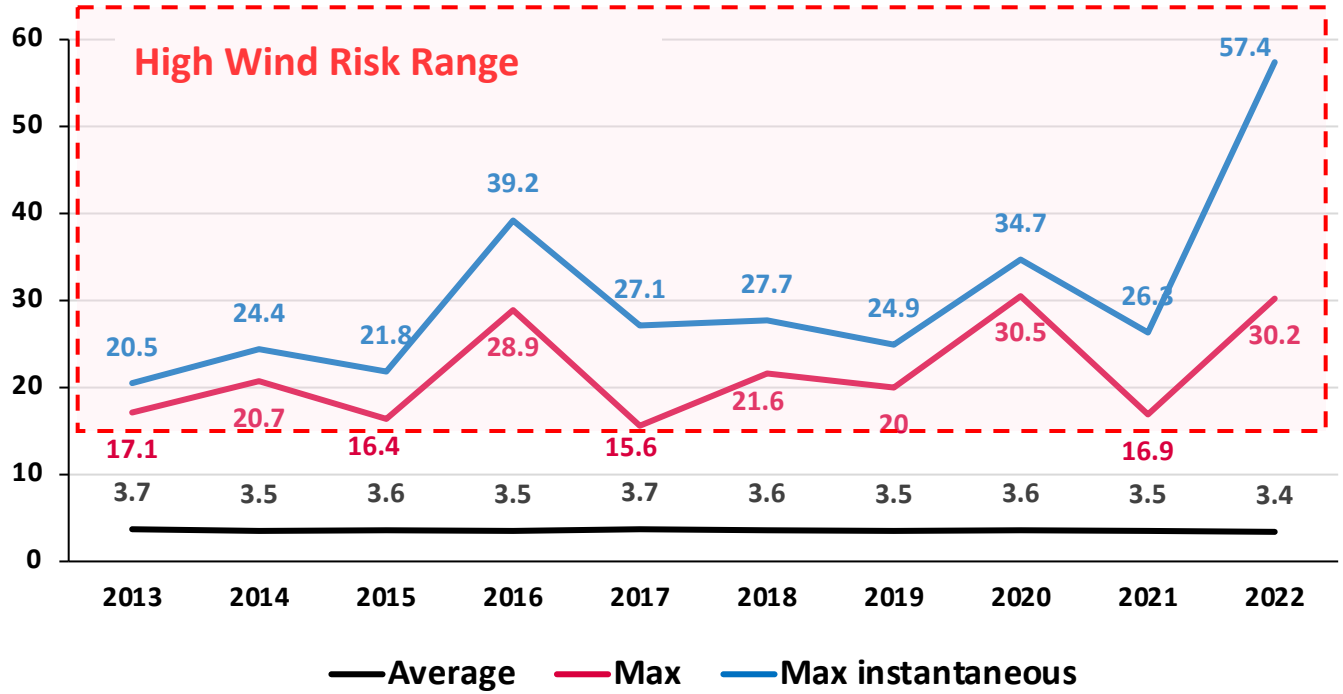
EMR area

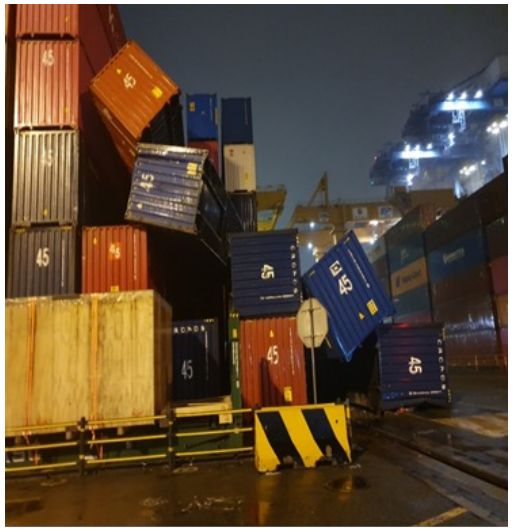
Stacking Area

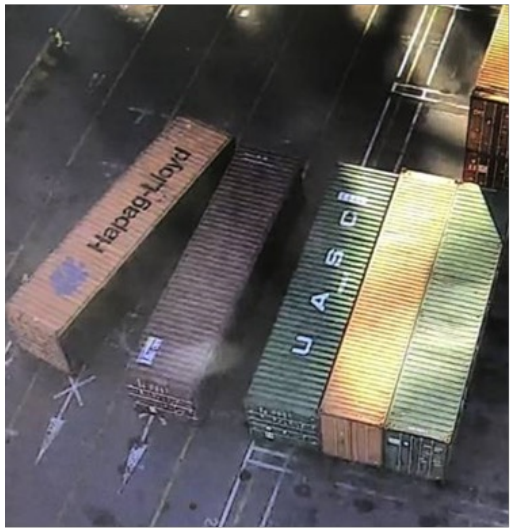


3. ON-LINE YARD SAFE SYSTEM

Wind Speed Yearly Average 2013~2022





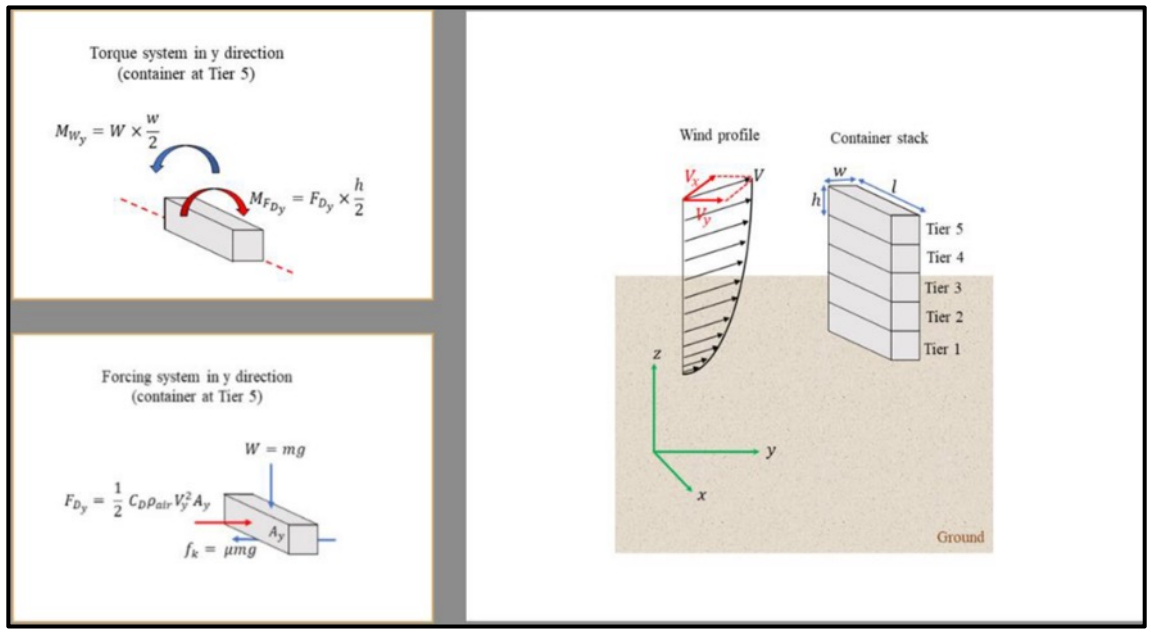


- High winds increasing in New-port area due to climate changes
- Typhoons, strong winds & gusts in the new port area are causing a constant risk of containers topple-down

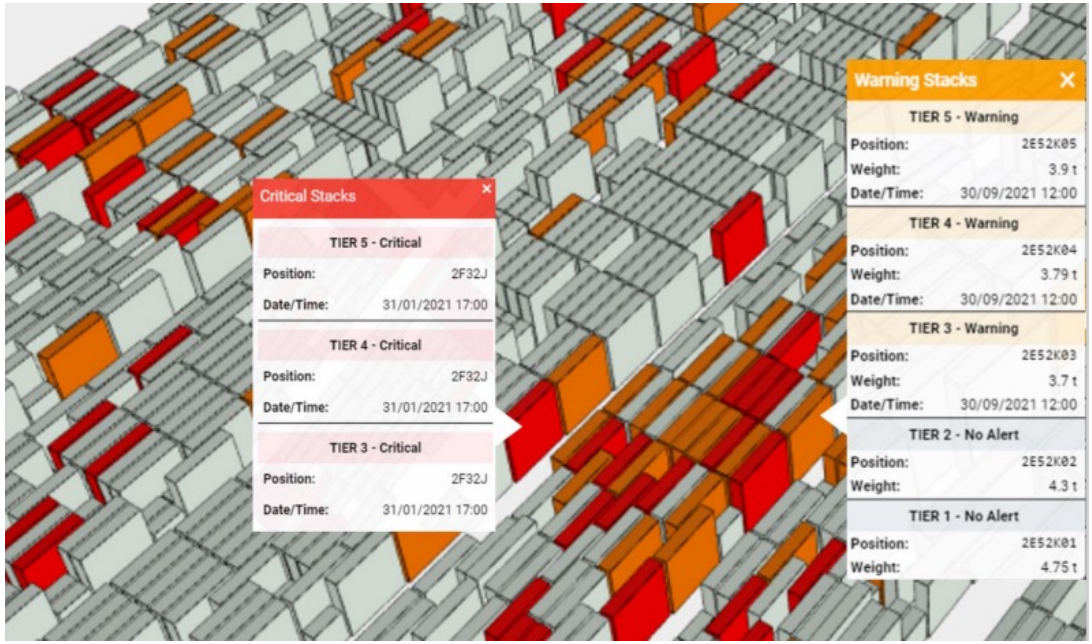
Ensure timely alerts and actions for yard safety from strong winds

- **Prevention of container toppling and planned/systematic early response to Strong Wind/Gust**
- **Cost Saving & Ops Efficiency Increase by reducing unnecessary leveling down re-handlings – 75-95% reduction**

Once high wind rises, the system calculates container weight, friction force, tier & height



Pre-alert of risky containers before 48 hrs

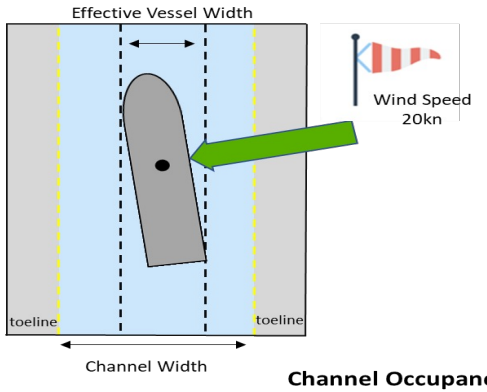


4. ON-LINE NAVIGATION / TOWAGE

Support to Piloting service with Real-Time weather

- **Lost time around weather events, multiple vessels in basin, towage requirements for large vessels**
- Real-Time Measurements, Feeding Data Assimilation and intelligent for 7 days in Advance updated every 6 hours

Notification to Pilot When Outside the Planned Course
Pilot Adjust Transit to AIS, GPS or Device Location



Channel Occupancy Check
No Exceedance

Vessel LOA = 300m
Vessel Beam = 40m
Drift Angle = 5°
Channel Width = toe to toe = 220m
Effective Vessel Width = 60m

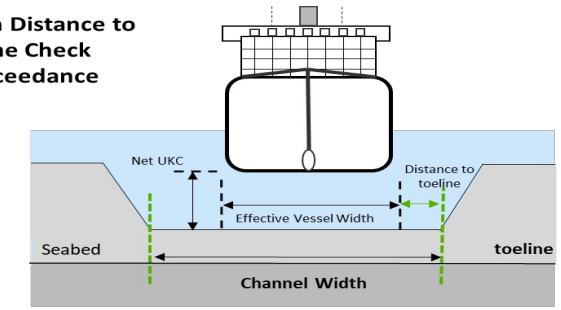
$$\text{Channel Occupancy} = \frac{\text{Effective Vessel Width}}{\text{Channel Width}} = 60/220 = 30\%$$

Channel Occupancy < Threshold

NCOS ONLINE
Channel Occupancy Checks

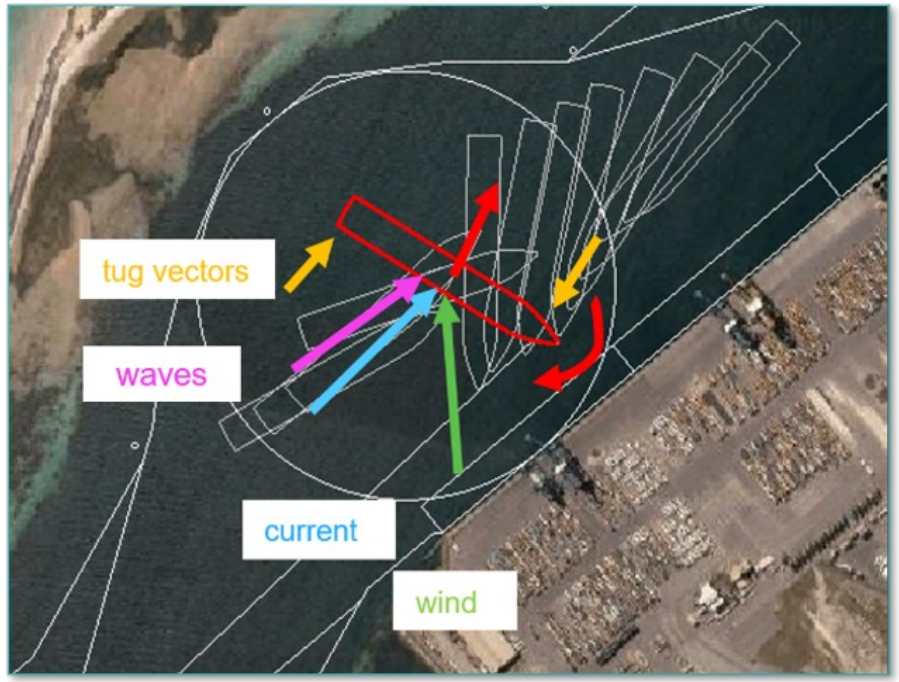
% of Channel Occupied by vessel width
& Minimum Distance to toeline

Minimum Distance to
Toeline Check
No Exceedance



Minimum Distance to toeline
< Threshold

Improve passage planning and communication
between pilots and tug masters



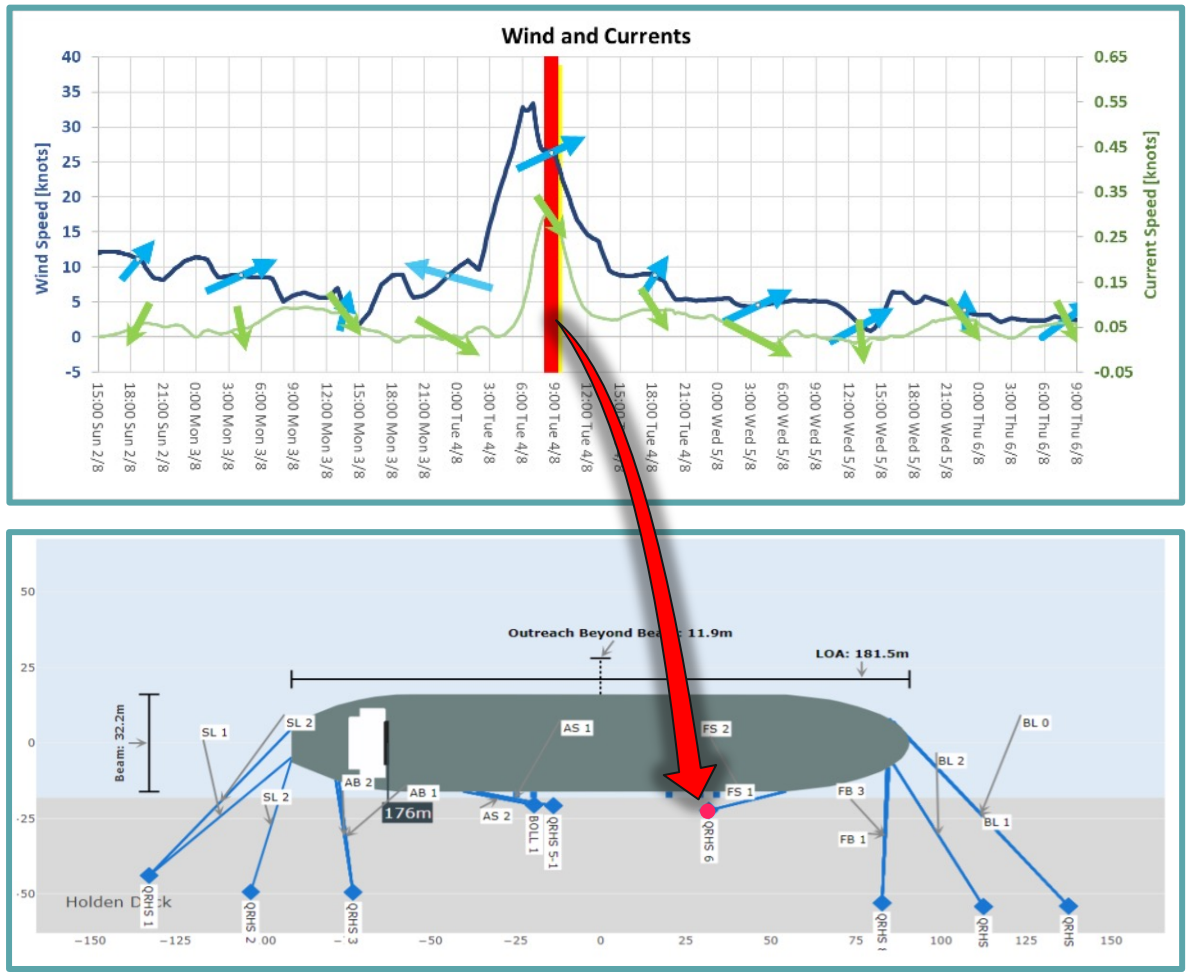
Terminal will get live mooring alert for risk to mooring

ONLINE MOORING REPORT

HOLDEN DOCK BERTH SAFETY REPORT
ETA 04 AUGUST 06:00 - ETD 06 AUGUST 12:00

Safety Notifications		
Alert	**Time**	**Details**
Failure	**8:01 AM 04 August**	**Bollard Force Exceeded (B4-50)**

Optimal Mooring proposal based on vessel, stay and weather conditions



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THANK YOU

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