The modern port automate the mooring handling

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The modern port automate the mooring handling

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  - How it works
  - Operational features & benefits
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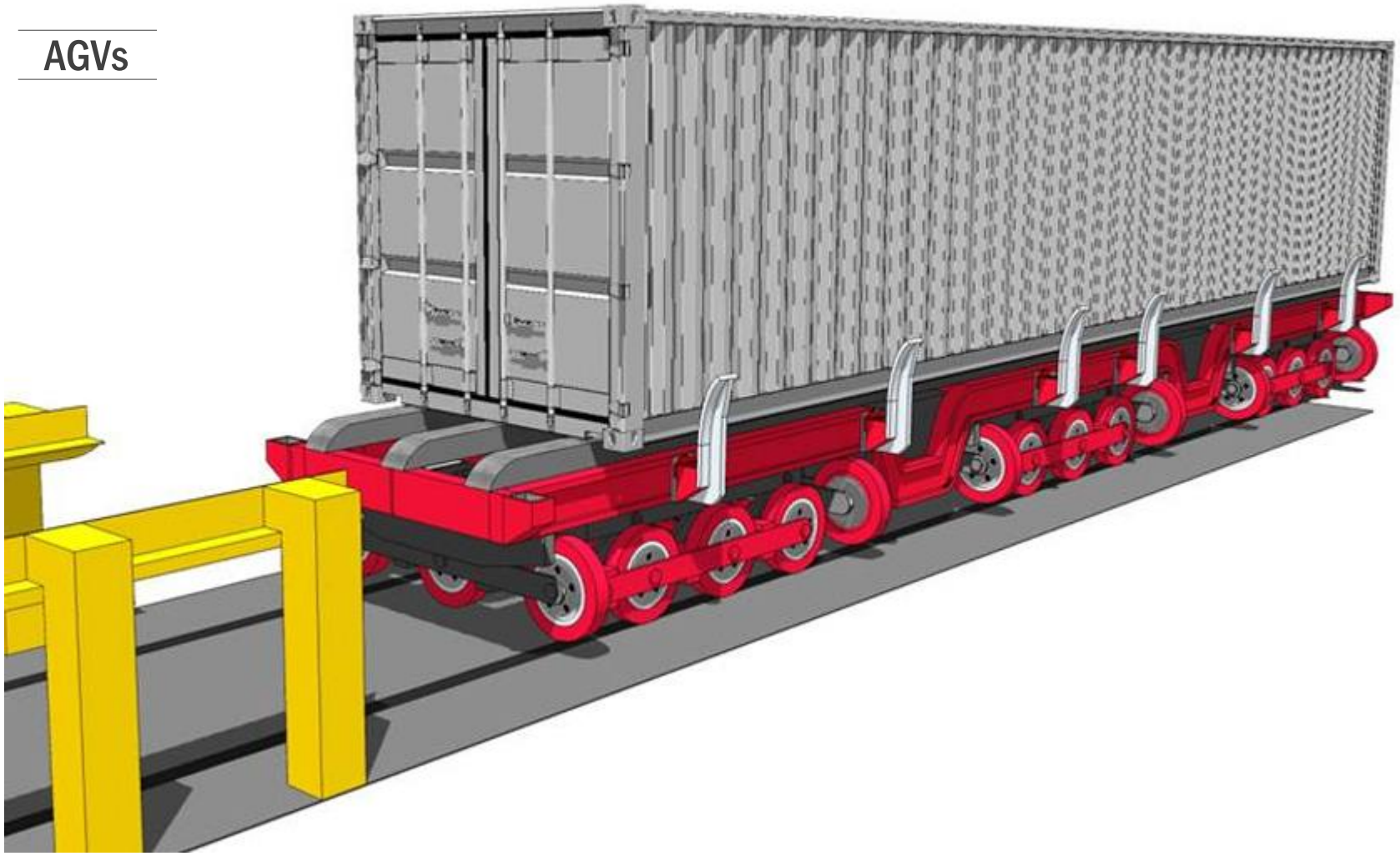
Ports & Maritime

Automation in the industry

Ports & Maritime

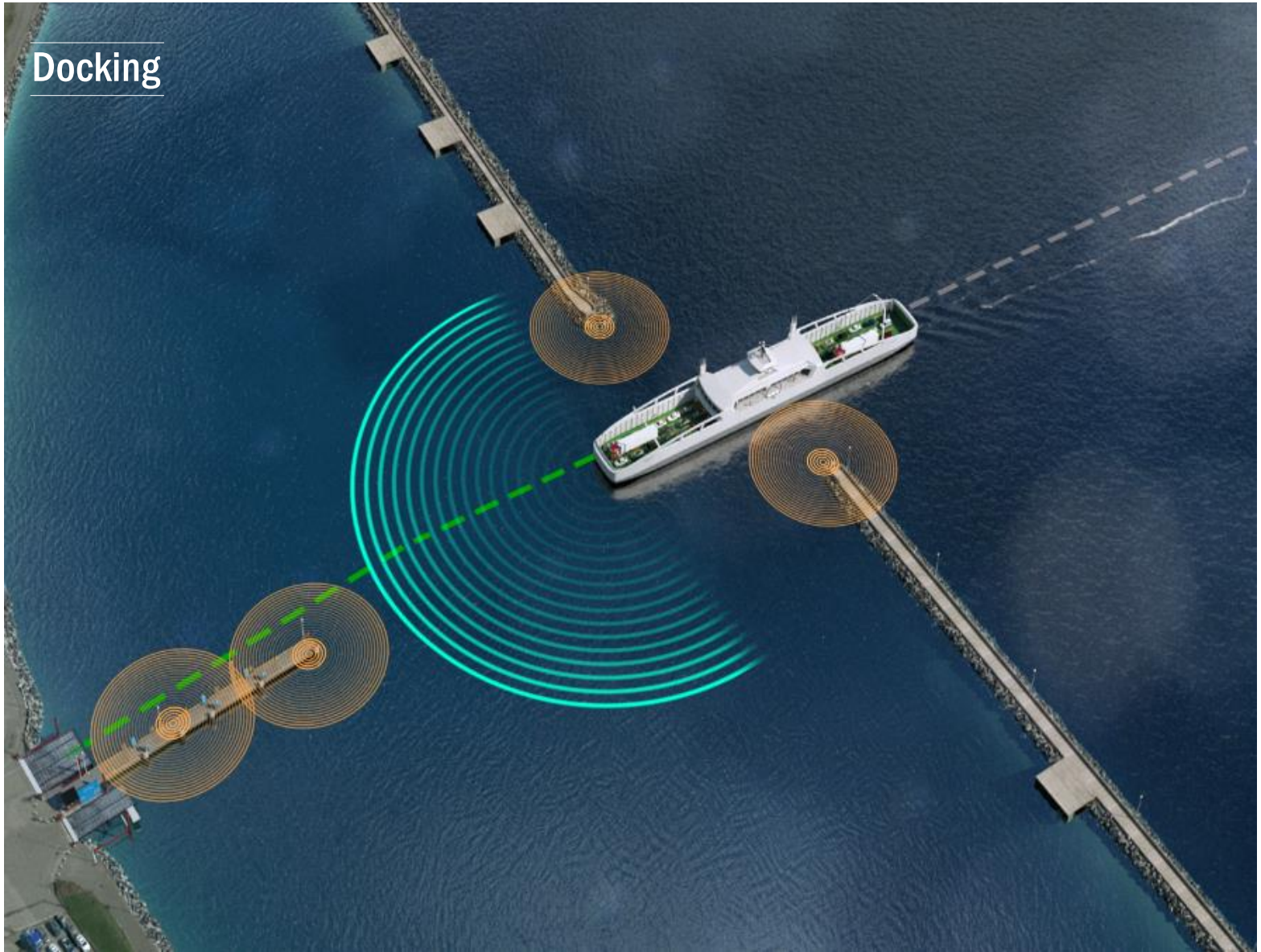
Automation in the industry

AGVs



Ports & Maritime

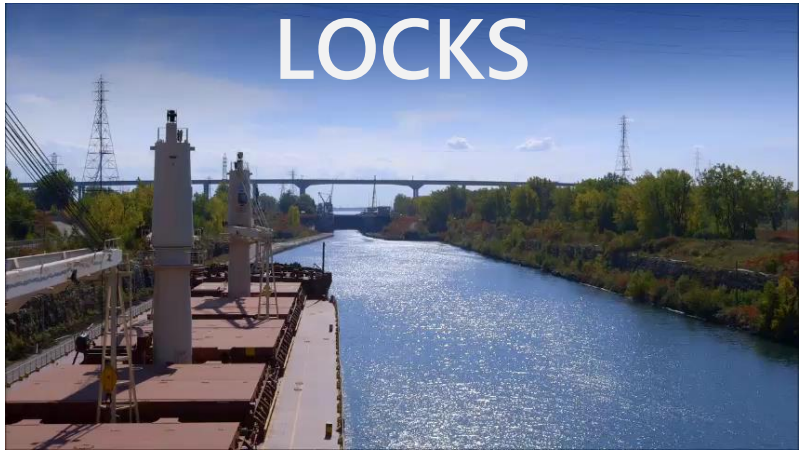
Automation in the industry



The modern port automate the mooring handling

Automation in the industry

Mooring



MoorMaster™ automated mooring

References

More than 300 MoorMaster™ units in service at some 100 unique sites worldwide by 2020.

MoorMaster™ systems have successfully completed more than 500,000 automated mooring operations to Q4 2018. By 2020, approximately 500,000 such operations will be made each year.

- Port of Salalah, Oman (5 installations)
- Port of Beirut, Lebanon
- Port of Ngqura, South Africa
- Port Hedland, Australia
- Port of Narvik, Norway
- 2 ferry terminals for Samsø Rederi, Denmark
- 4 ferry terminals for Faergen, Denmark
- Ports of Melbourne & Devonport, Australia
- Port of Marlborough, New Zealand
- Port of Wellington, New Zealand
- Ferry terminal for Teso, Netherlands
- 2 ferry terminals for Norled, Norway
- 2 ferry terminals for Fjord1, Norway
- 2 ferry terminals for Finferries, Finland
- Port of Helsinki, Finland
- 2 ferry terminals for Wightlink, UK
- 2 ferry terminals for Newfoundland and Labrador ferries, Canada
- Brisbane, Australia
- Great Lakes, Canada & USA
- US Navy, USA
- Connect LNG, Norway

- Container handling
- Bulk
- Ferry & Ro/Ro
- Dredging
- Locks
- Ship-to-ship
- Installation pending

No personnel injuries

- 4 ferry terminals for Sør Trøndelag Kommune, Norway – *Expected operation Q1-19*
- 6 ferry terminals for Fjord1, Norway – *Expected operation Q1-19*
- 3 ferry terminals for Aeroe Ferries, Denmark – *Expected operation Q2-19*
- 6 ferry terminals for Boreal Sjø, Norway – *Expected operation Q4-19*
- 24 ferry terminals for Fjord1, Norway – *Expected operation Q1-20*
- 5 ferry terminals for Ontario Transport – *Expected operation Q2-20*

Automated vs conventional

Conventional mooring

An old “tradition” that still need to be improved…

A lot of people with hands on…

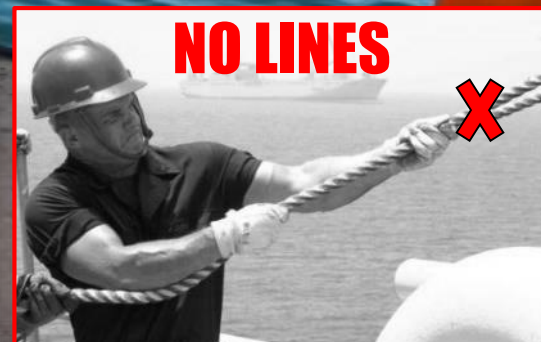
Unpredictable - dangerous

High Load points **Labour intensive** **Limited effectiveness**

Manual operation **“Old” / Obsolete** **Time consuming**

Hands off the mooring ...

- One remote operator



MoorMaster™

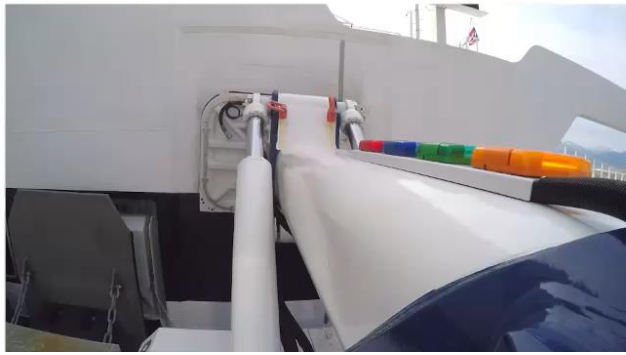
How it works

Automated vacuum mooring

The time it takes…

Moor 25-30 sec

Detach 10-15 sec



20t holding power

1400 x 1900 mm

MoorMaster™ automated mooring

Large vacuum pads instead of mooring lines

20t holding power

Automated vacuum mooring

MoorMaster™

- Steel construction
- Neoprene rubber seal
- Effective sealing area = 2.55m^2
- Suction force = 20 tonnes
- 26mm lip to seal around obstructions
- Tested by DNV

- Surface must be relatively flat
- Seal will adapt to minor obstructions
- Vacuum accumulator
- 10-20 minutes of attachment on poor surface in case of power failure

Automated vacuum mooring

MoorMaster™ - Range of motion & Forces

HOLD

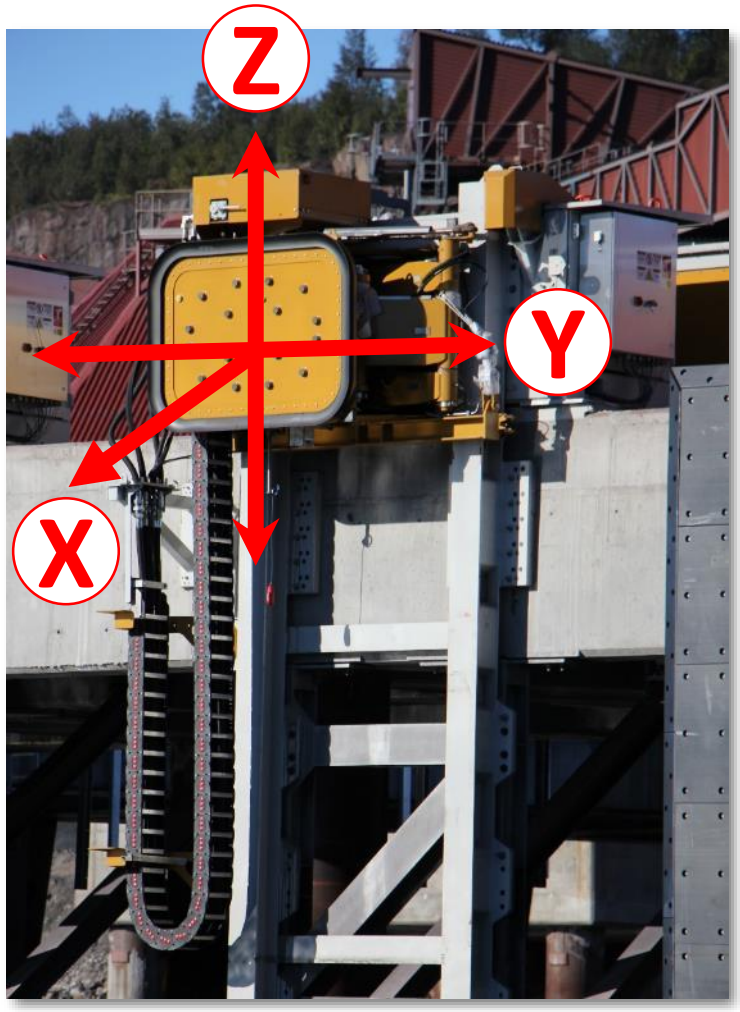
- **In-Out motion (“X” axle - perpendicular to berth)**
  - *Mechanically limited / range dependent on linkage geometry*
  - *Movement beyond mechanical limit will result in decoupling*
  - *Max strength at 80% vacuum : **20 tons per pad***

DAMPEN
WHARP
REPOSITION

- **Left-Right motion (“Y” axle - parallel to berth)**
  - *Range dependent on linkage geometry*
  - *Movement beyond mechanical limit will result in decoupling*
  - *Max strength at 80% vacuum : **10 tons per pad***

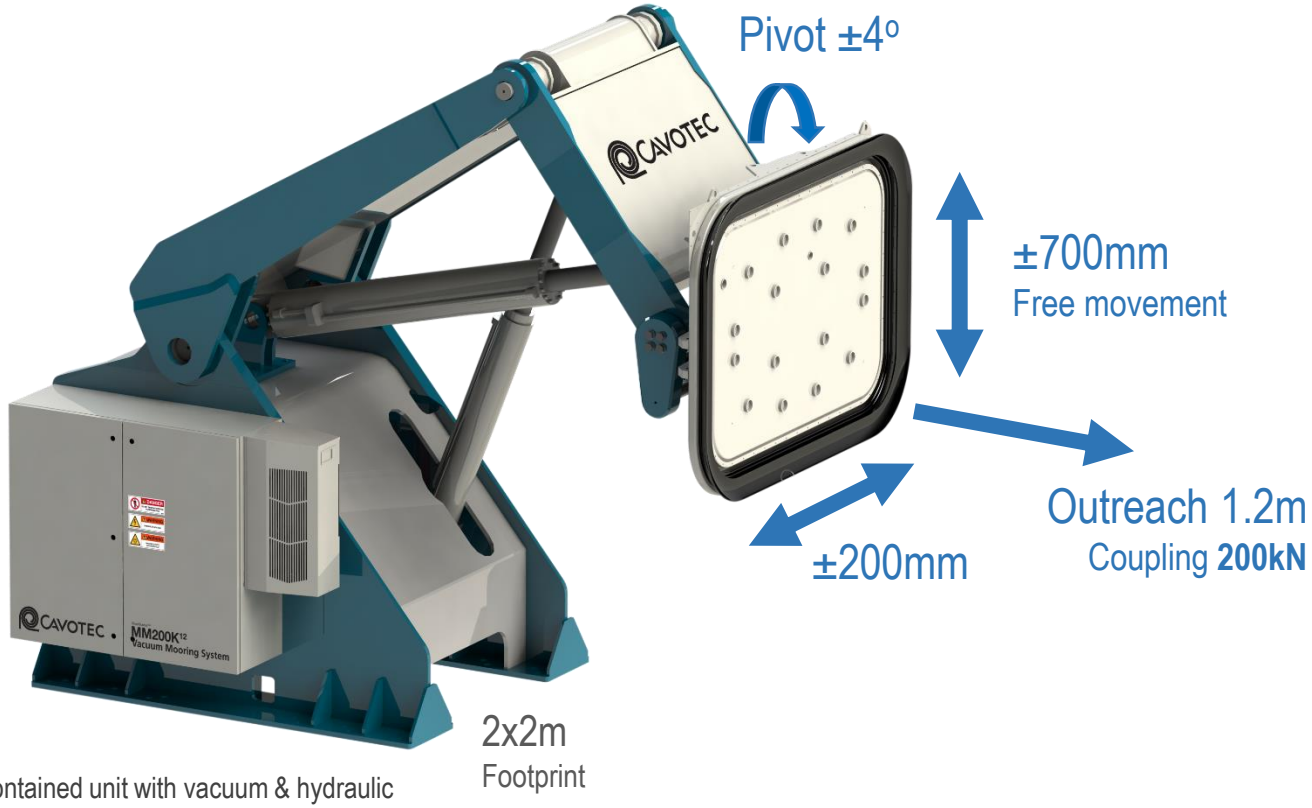
FREE
NEUTRAL

- **Up-Down motion (“Z” axle - vertical to berth)**
  - *Unlimited with ‘stepping’*
  - *Vertical rails length depending on various factors*

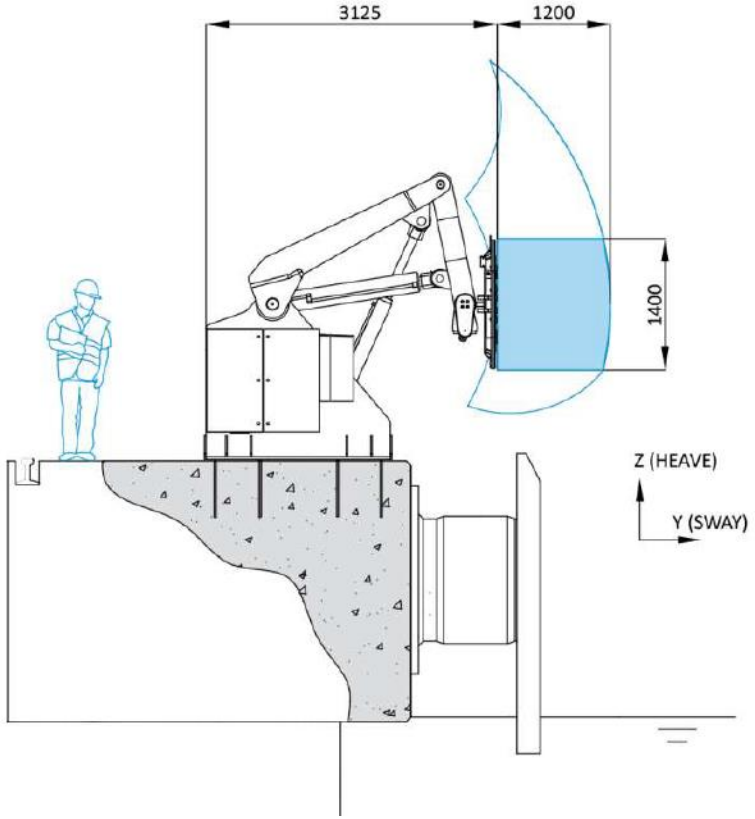


Automated vacuum mooring

MoorMaster™ - a typical TOP-mounted unit

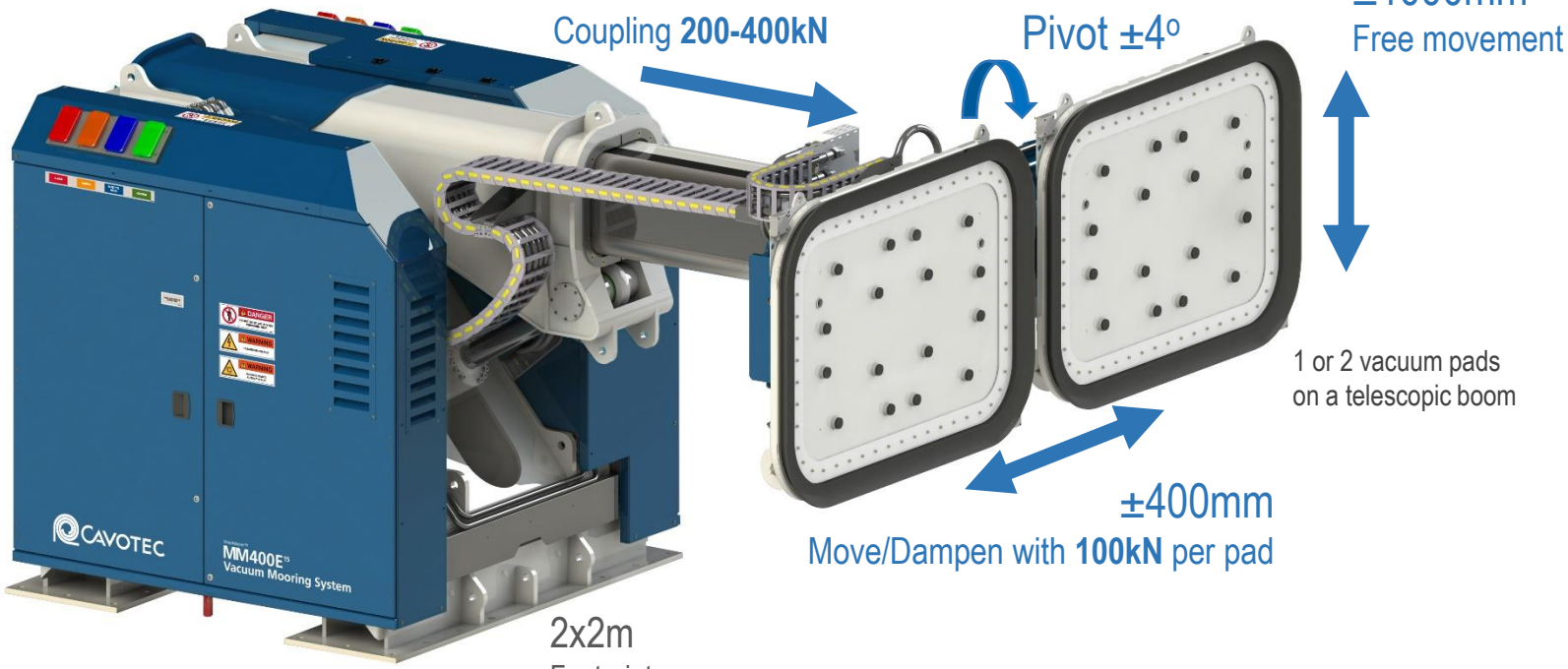


Self contained unit with vacuum & hydraulic pumps, Oil tank, electrical panel a.o.

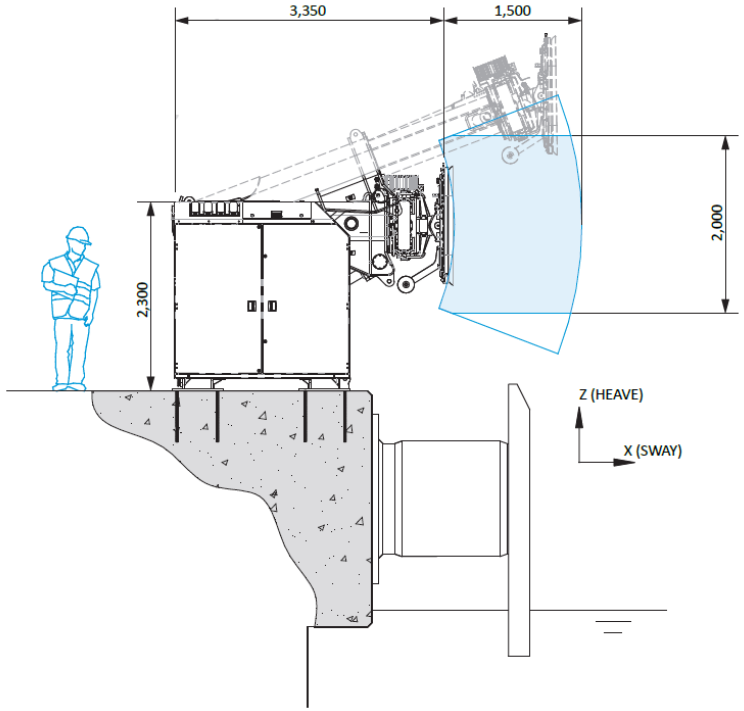


Automated vacuum mooring

MoorMaster™ - a typical TOP-mounted unit



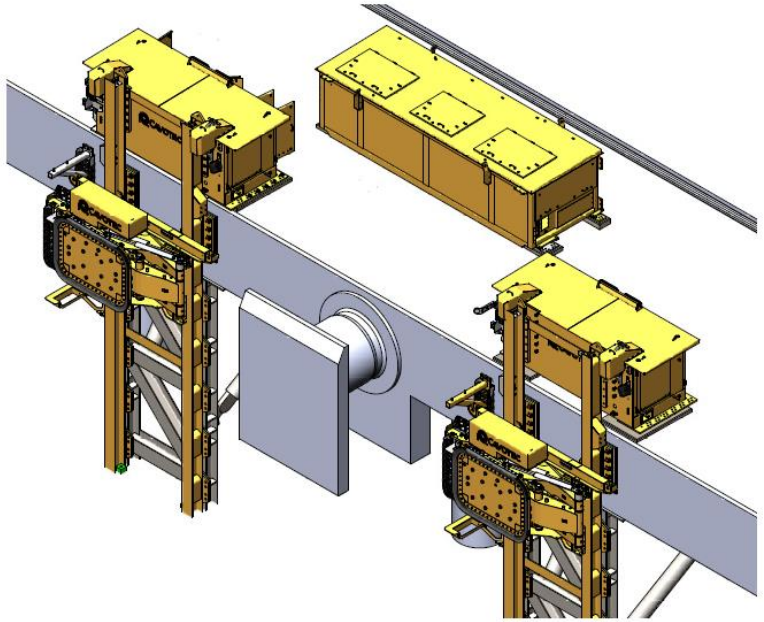
Self contained unit with vacuum & hydraulic pumps, Oil tank, electrical panel a.o.



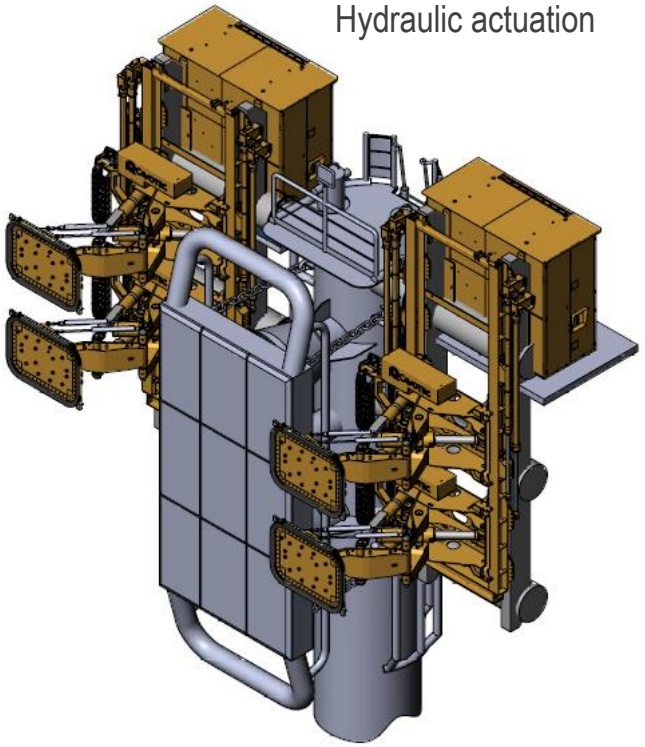
Automated vacuum mooring

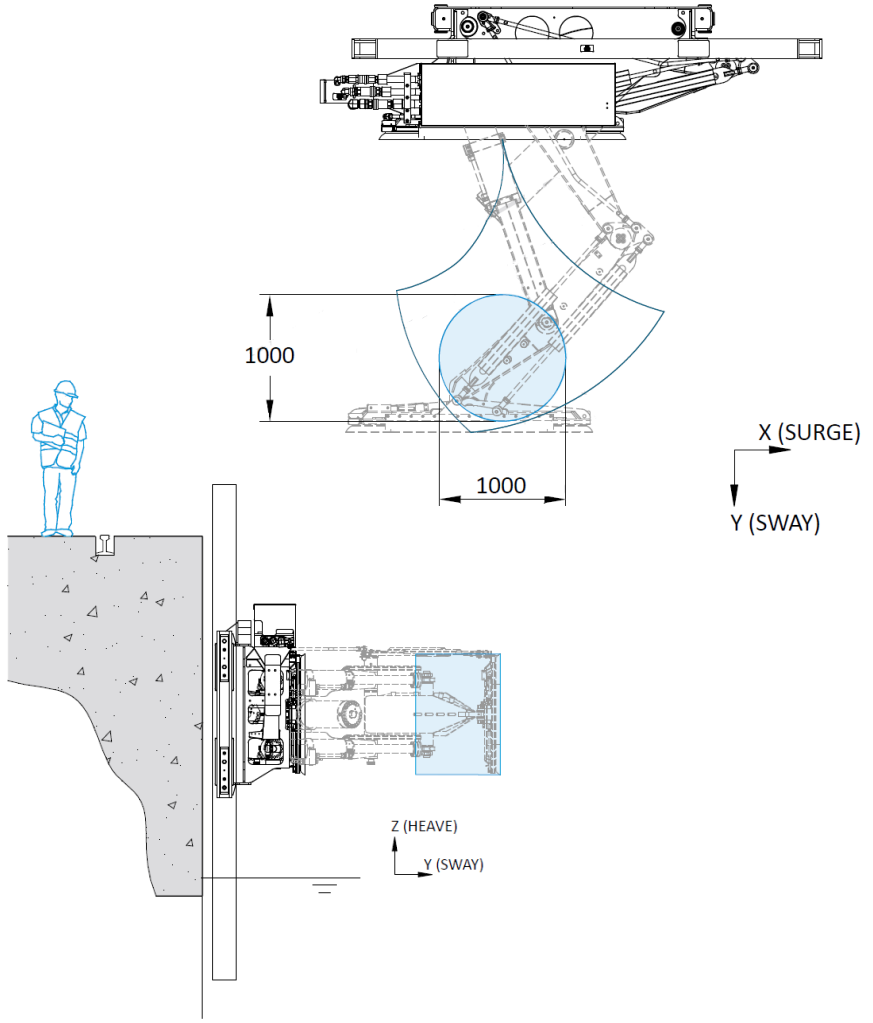
MoorMaster™ - a typical FRONT-mounted unit

Winch actuation



Hydraulic actuation





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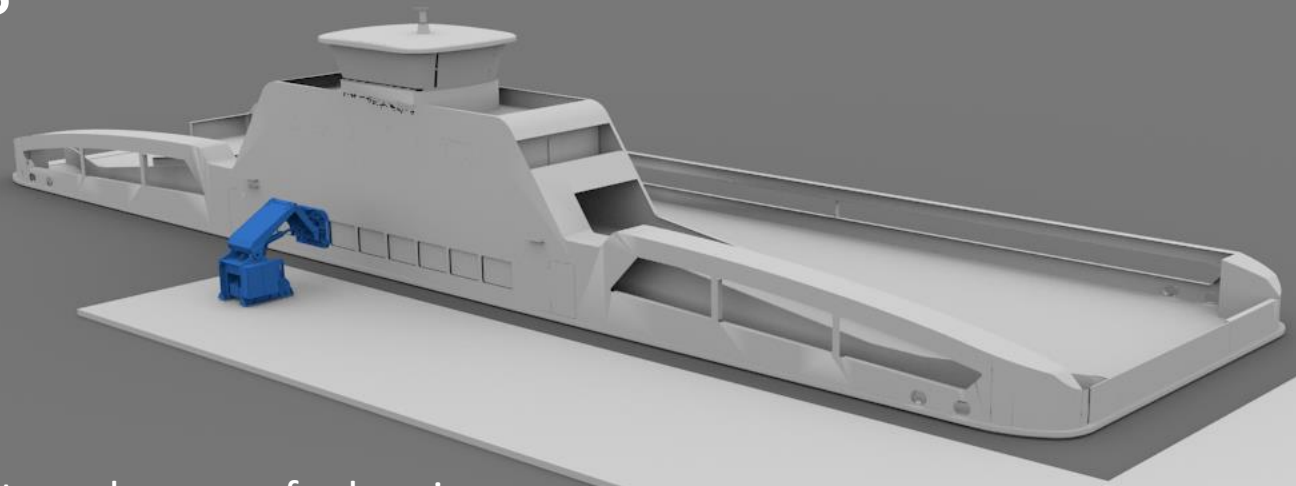
Automated mooring example

small ferries



- Extended time for battery charge or fuel saving
- Unmanned ferry berth
- Short pier

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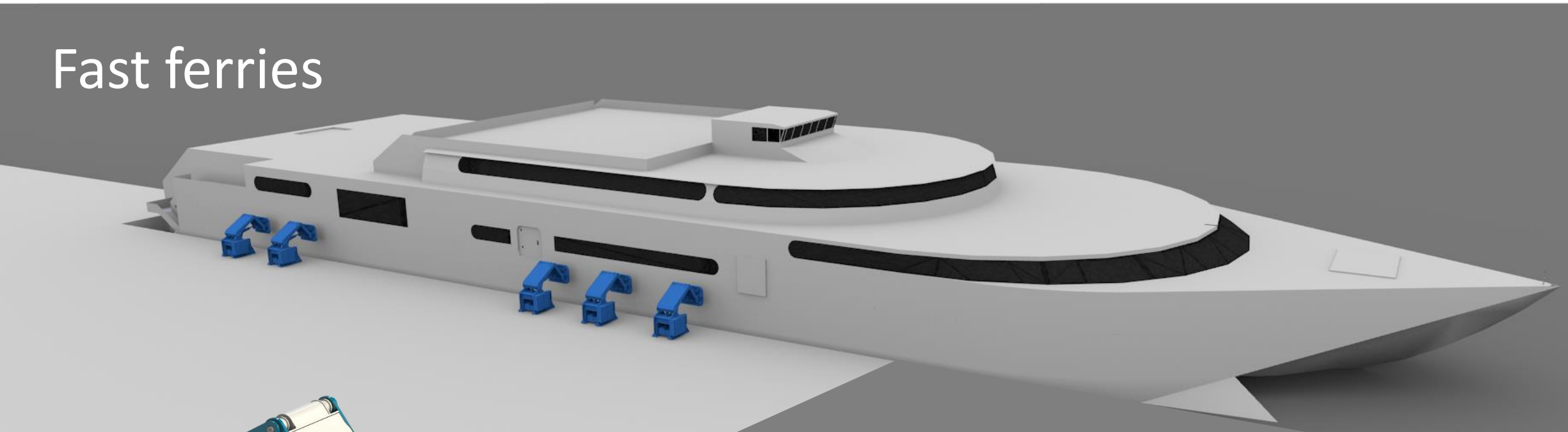
Automated mooring example

Fast ferries



- Fuel saving
- Possibility for short pier
- Unmanned ferry berth

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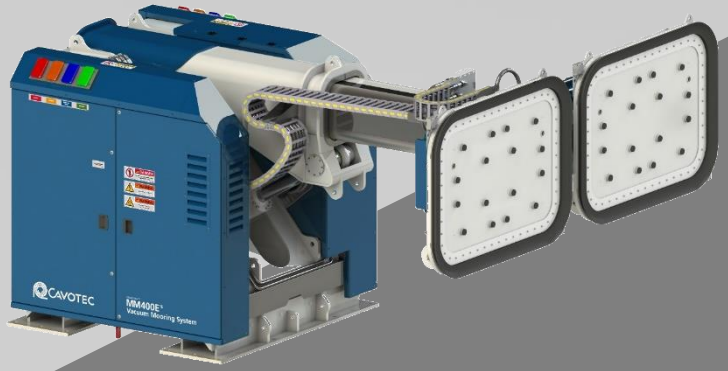
Automated mooring example

Large RoPax



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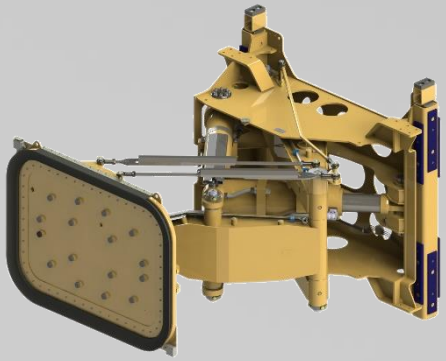
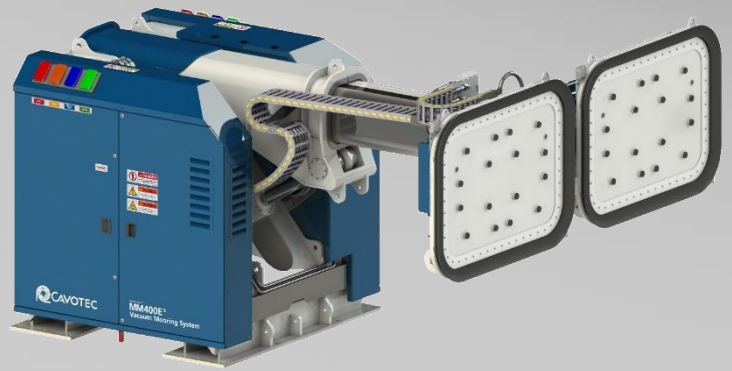
Automated mooring example

Container & Bulk





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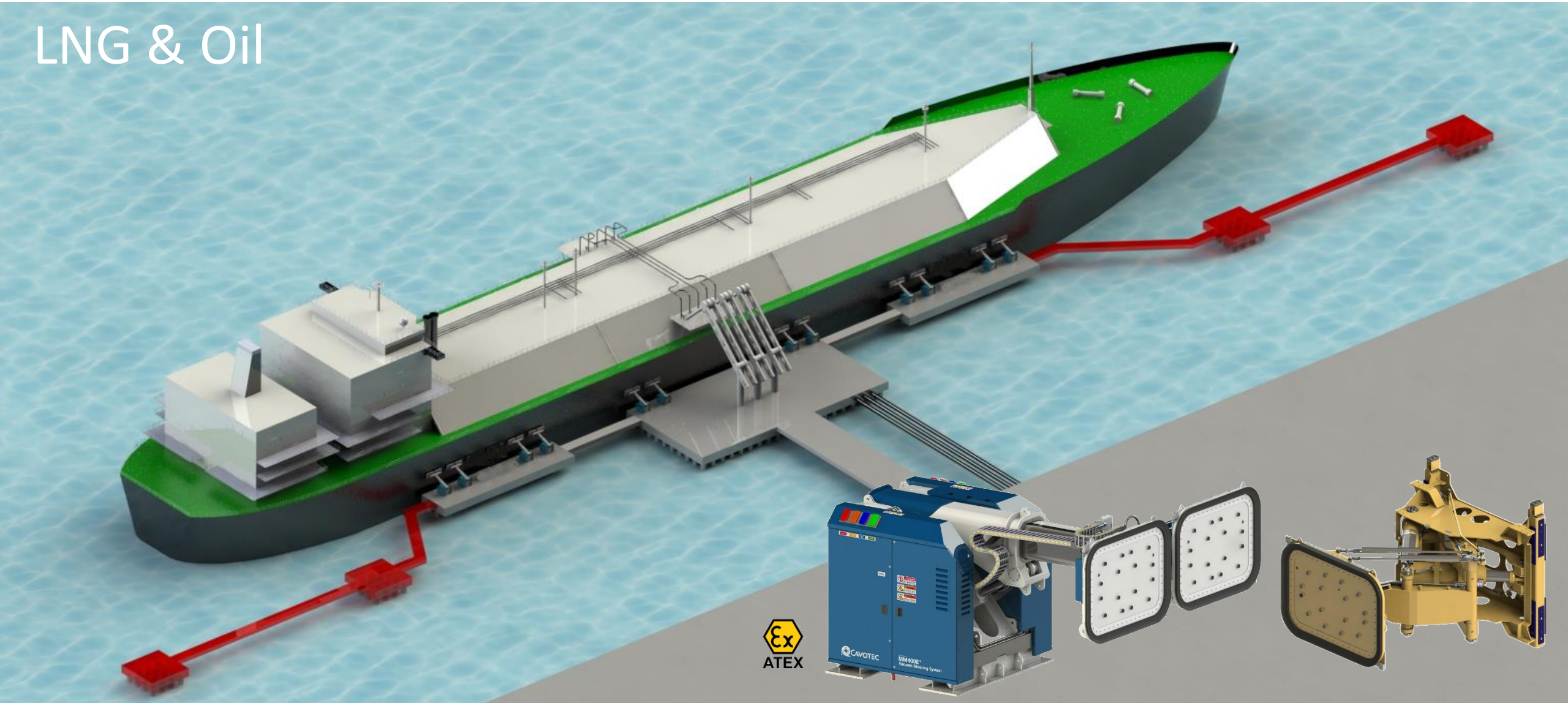
Automated mooring example



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Operational features & benefits

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Operational features and benefits

Automation

- **DETECTION & RTM**
- **SHIP OFF FENDER LINE**
- **TIDAL/DRAFT ADAPTION**
- **MOTION DAMPENING**
  Surge, Sway & Yaw
- **PARKING**

Control

- **REMOTE**
- **STATUS, TRENDS & LOGS**
- **CRITICAL ALARMS**

Time

- **MOORING**
  ~ 30 seconds
- **REPOSITIONING**
  ~ 10-15 seconds
- **DETACH**
  ~ 10 seconds

Staff

- **1**
  Operator

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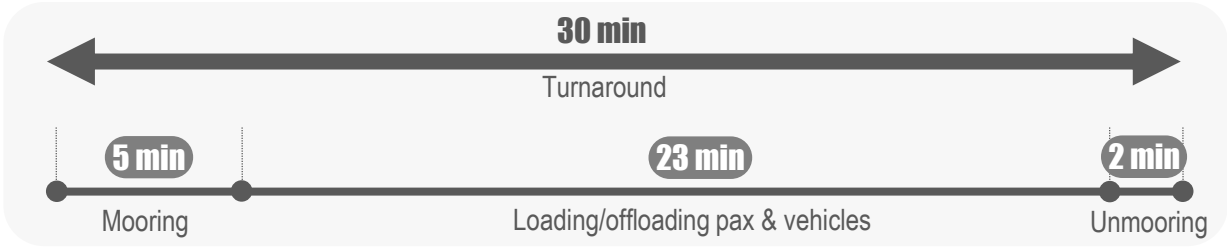
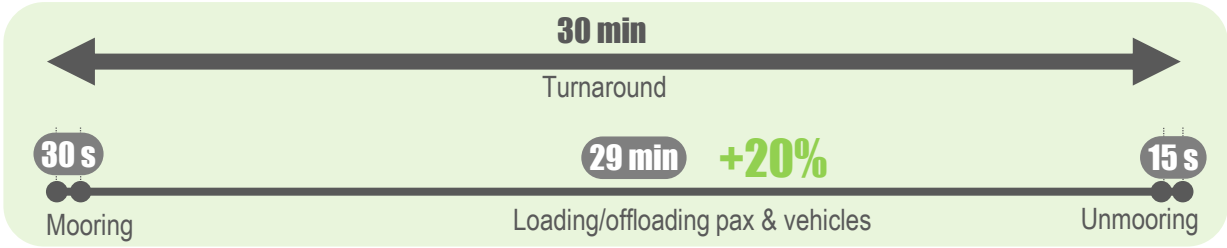
Time benefits - Ferry example

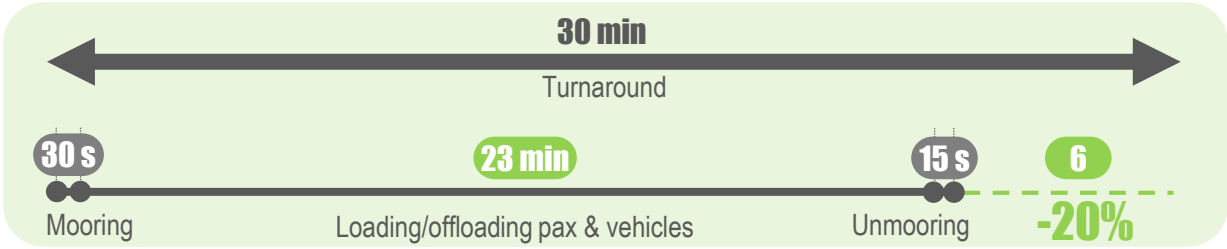
Conventional mooring



Automated mooring



Automated mooring



Time benefits - Container terminals

Conventional mooring

Automated mooring

Other benefits

Environment

Other benefits

Infrastructure

Virtual quay




Breakwater

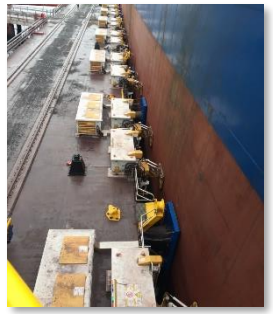


Other benefits

Maintenance







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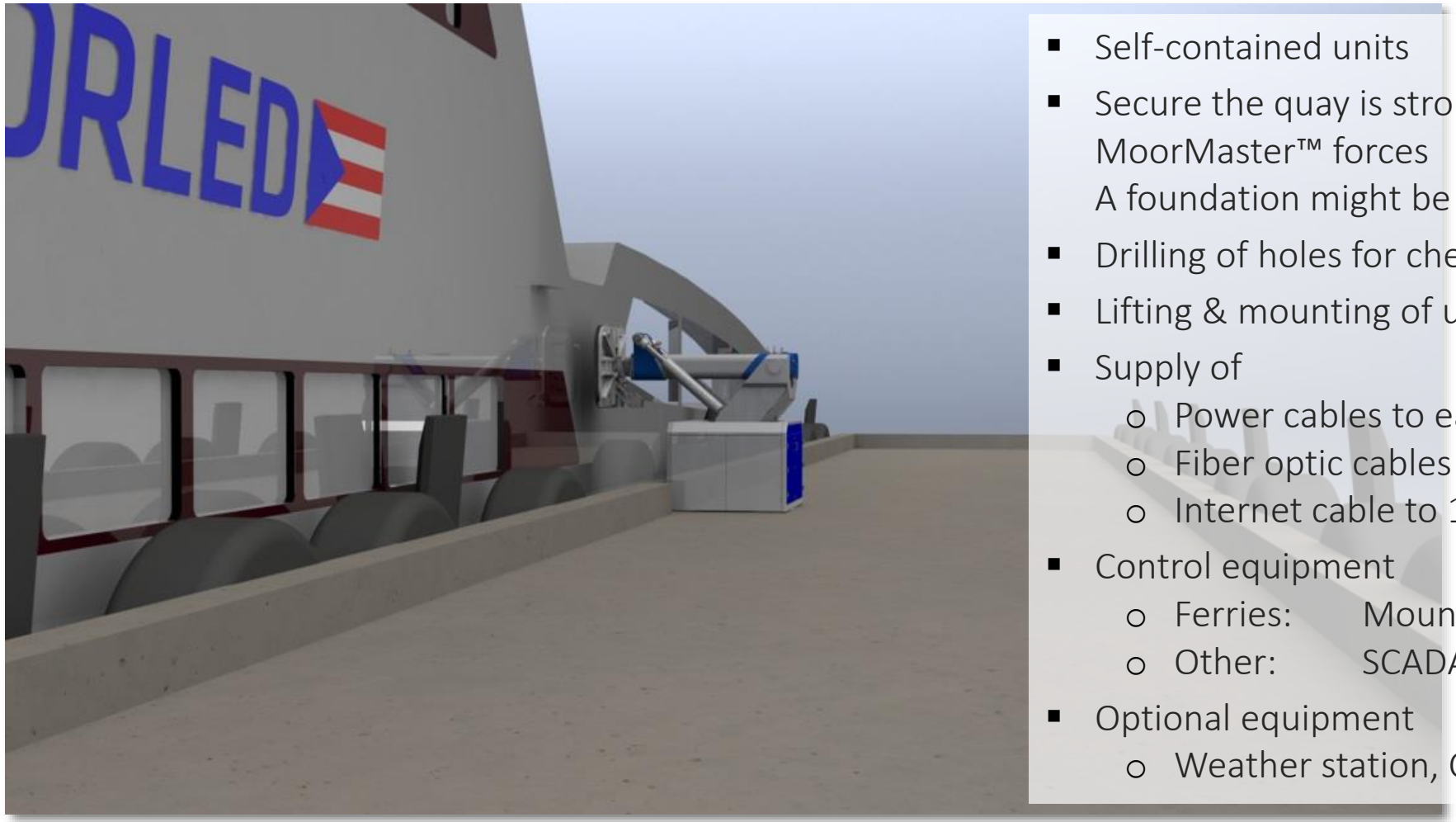
What it takes…

MoorMaster™ automated mooring

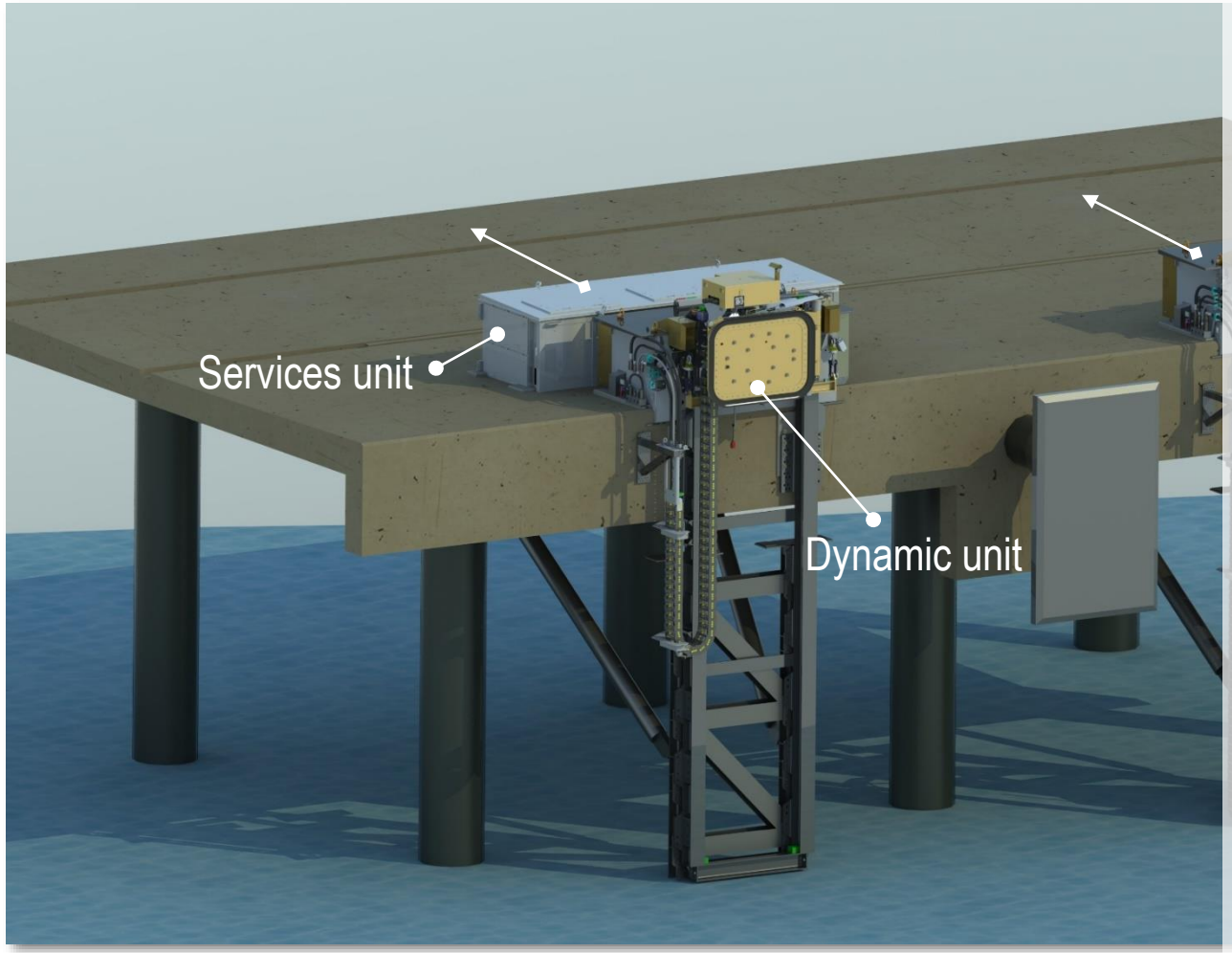
What it takes to get automated



- Self-contained units
- Secure the quay is strong enough to handle MoorMaster™ forces
  A foundation might be needed
- Drilling of holes for chemical anchors. Grouting of feet.
- Lifting & mounting of units
- Supply of
  - Power cables to each unit (20-32kW)
  - Fiber optic cables between units
  - Internet cable to 1 unit
- Control equipment
  - Ferries: Mount onboard
  - Other: SCADA, Tough pad
- Optional equipment
  - Weather station, Cameras, Back-up generators etc.

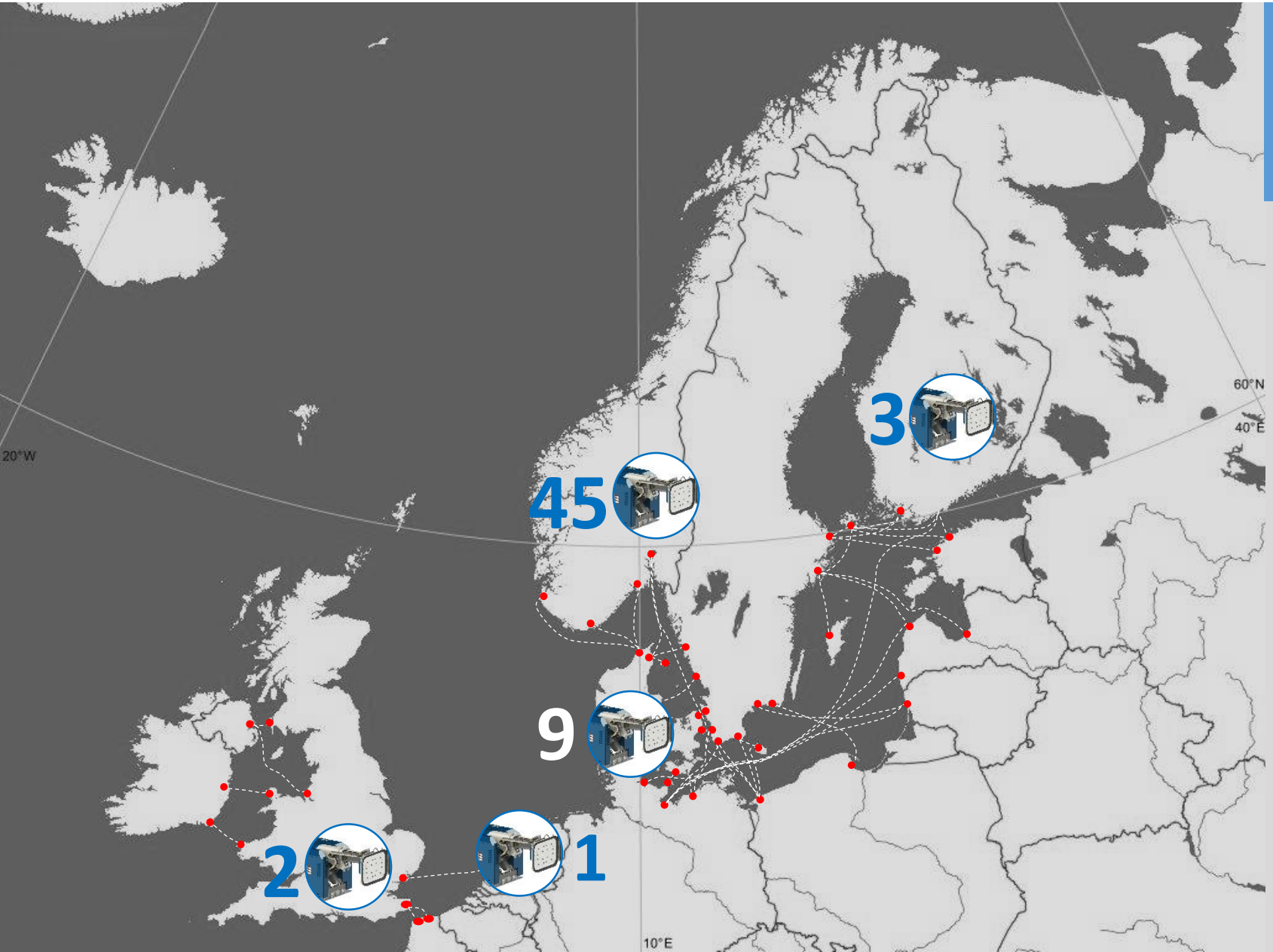
MoorMaster™ automated mooring

What it takes to get automated



- Dynamic unit separated from Services unit
- Secure the quay is strong enough to handle MoorMaster™ forces
- Mounting of vertical rails. Drilling of holes for chemical anchors. Grouting of feet. Mounting of services units
- Lifting & mounting of dynamic units
- Supply of
  - Power cables to each unit (30-50kW)
  - Fiber optic cables between units
  - Internet cable to 1 unit
- Control equipment
  - Ferries: Mount onboard
  - Other: SCADA, Tough pad
- Optional equipment
  - Weather station, Control room, Cameras, Back-up generators etc.

MoorMaster™ sites - **North Europe**



60 sites

91 MoorMaster™ machines in total

+50 sites

Potentially with positive ROI

Denmark - Sweden/Norway
Germany - Scandinavia/Baltics
Sweden - Baltics
Poland - Sweden
UK - France

MoorMaster™ automated mooring

Why automate the mooring

The good reason could be:

- Congestion
- Turnaround issues
- New infrastructure plans
- Safety issues
- Environmental targets

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Ready for a change ?!

Thank you for your attention

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Questions to jakob.tolsgaard@cavotec.com or +45 2616 1300

HANDLING IRON ORE CARRIERS

Australia & Norway

- **LARGER VESSELS** at short Jetty
- Elimination vessel motion caused by **PASSING SHIPS**
- Automated **WHARPING**
- Improved personnel **SAFETY**
- Increased **CARGO THROUGHPUT**

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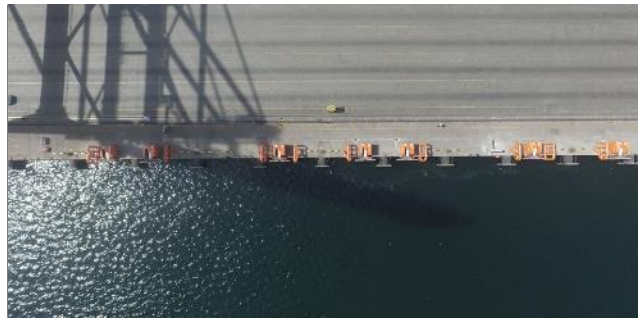
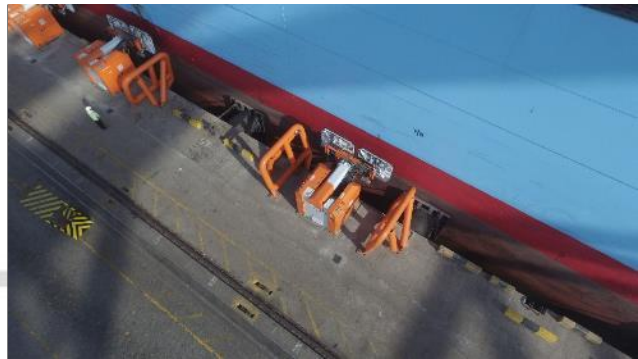
Since 1999

MOORING CONTAINER VESSELS

in Oman, Lebanon & South Africa

- **VESSEL SURGE** reduced
- Improved container handling **EFFICIENCY**
- Only **ONE OPERATOR** for mooring handling
- Less **PILOT** & **TUG** time needed
- **BREAKWATER** construction avoided





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HANDLING DREDGING VESSELS

in Brisbane (Australia)

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- Saved valuable **PROJECT TIME**
- Improved **PERSONNEL SAFETY**
- Reduced **VESSEL MOTIONS**

Part of an airport project

MOORING & CHARGING ELECTRIC FERRY

in Lavik & Oppedal (Norway)

- More **CHARGING TIME**
- **ACCURACY** of ferry position
- Faster **TURNAROUND TIME**
- No need of **SHORE CREW**

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MOORING SMALLER FERRIES

in Denmark

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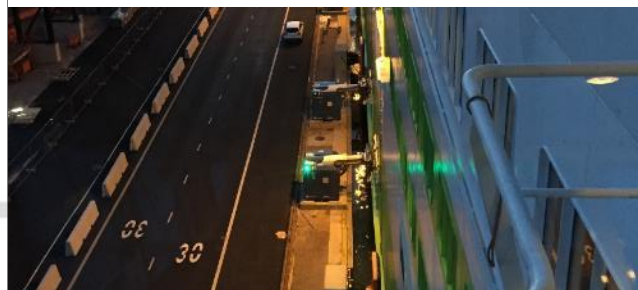
- **INFRASTRUCTURE COST** savings from short berths
- **NO SHORE CREW** needed
- Reduction of **SHIP CREW**
- Faster **TURNAROUND TIME**
- Less rope & winch **MAINTENANCE**

MOORING LARGE FERRIES

in Helsinki (Finland)

- Better **UTILIZATION** of shore **CREW**
- Excellent **SERVICE** for their clients, the ferry lines
- Improved personnel **SAFETY**
- **EU FUNDING** (Automation)



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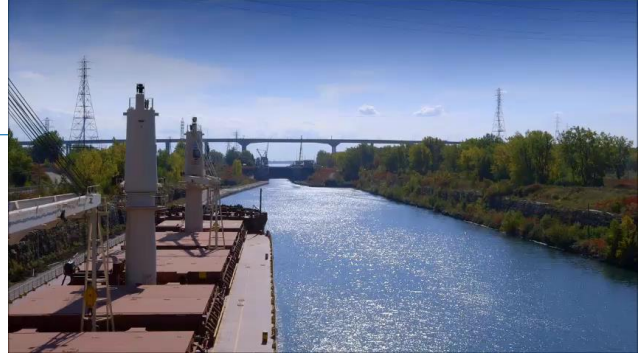
MOORING GENERAL CARGO VESSELS

in 15 locks (Canada & USA)



- **ONE MOORING OPERATOR** instead of 3
- **FLEXIBILITY** improvement
- Faster **TURNAROUND TIME**
- Improved personnel **SAFETY**

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MoorMaster™ automated mooring

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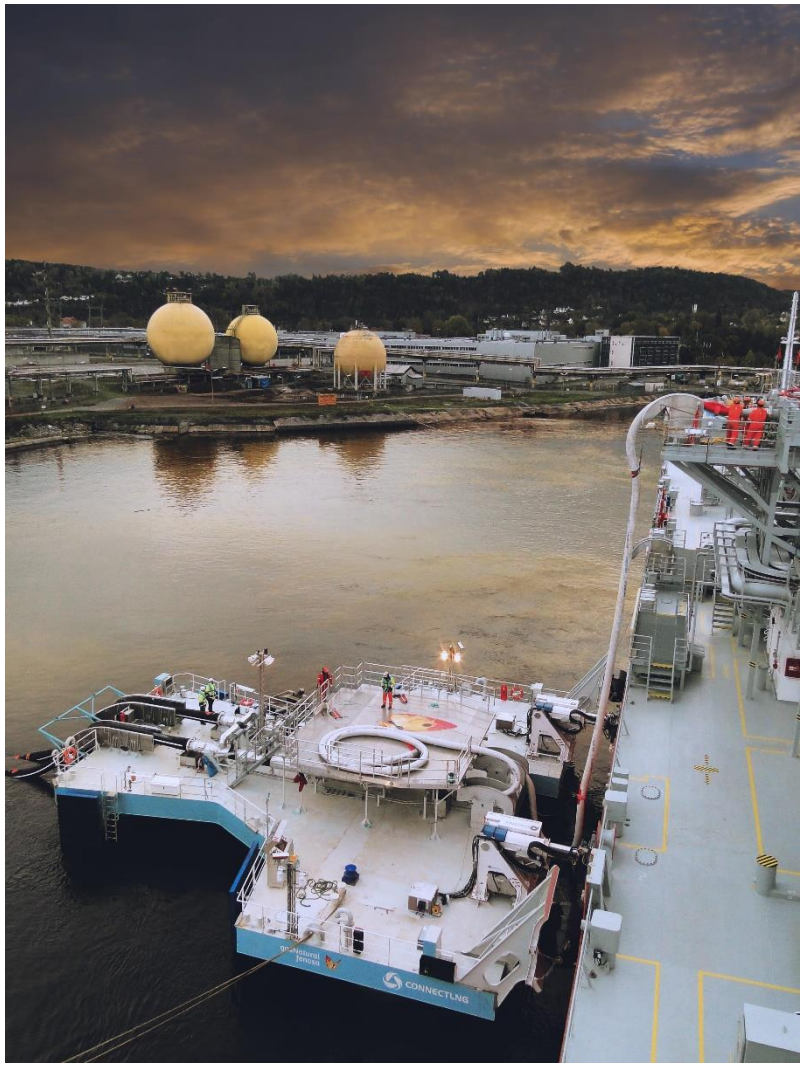
SHIP TO SHIP - CLNG, Norway



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What you get

MoorMaster™ automated mooring

What you get

IMPROVED COMPETITIVENESS

- Improved efficiency
- Highest Safety standard
- Reduced Engine time
- Improved berth flexibility

MoorMaster™ automated mooring

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What you get

MORE TIME for

- Loading/unloading cargo
- Recovering delays
- Utilization of shore & ship crew
- Throughput capacity

MoorMaster™ automated mooring

What you get

REDUCED RISKS for

- Personnel **Safety** & port **Security**
- Ground personnel dependence
- Time table delays
- Infrastructure damages
- Environment

Extra for questions…

MoorMaster™ automated mooring

What if there is a power cut ?

- The typical duration of the vacuum pads still to hold on to the vessel is between 15 minutes and 15 hours dependent on the vacuum seal against the hull
- The control system continues to monitor system and sound alarms as it has UPS back power on the control system.
- System hydraulics and vacuum systems do not operate.
- Where the power grid is considered a significant risk, a back-up generator should be employed.

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Are the vacuum pads leaking ?

- The efficiency of the seal is related to surface condition and the efficiency of the couple.
- A poor seal will mean that vacuum pumps may run continuously or start up frequently to maintain pre-set vacuum levels.

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Do you still need fenders ?

- Yes
- Conventional fenders are required for absorbing berthing loads

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Does the ship needs strengthening ?

- Few ships need any reinforcement
- However, steel structures with a thickness below 10mm should be examined more closely
- Note that the force exerted on the hull by MoorMaster™ is never more than 1 atmosphere and therefore less than that from fenders

MoorMaster™ automated mooring

What is the back-up ?

- Same as with conventional mooring methods:
  - Switch on thrusters or
  - Call on tug assistance or
  - Leave the berth