ShoreTension®
DYNAMIC MOORING SYSTEM

ShoreTension® Mooring System

Innovation in mooring seagoing vessels

Dynamic mooring system©

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Background

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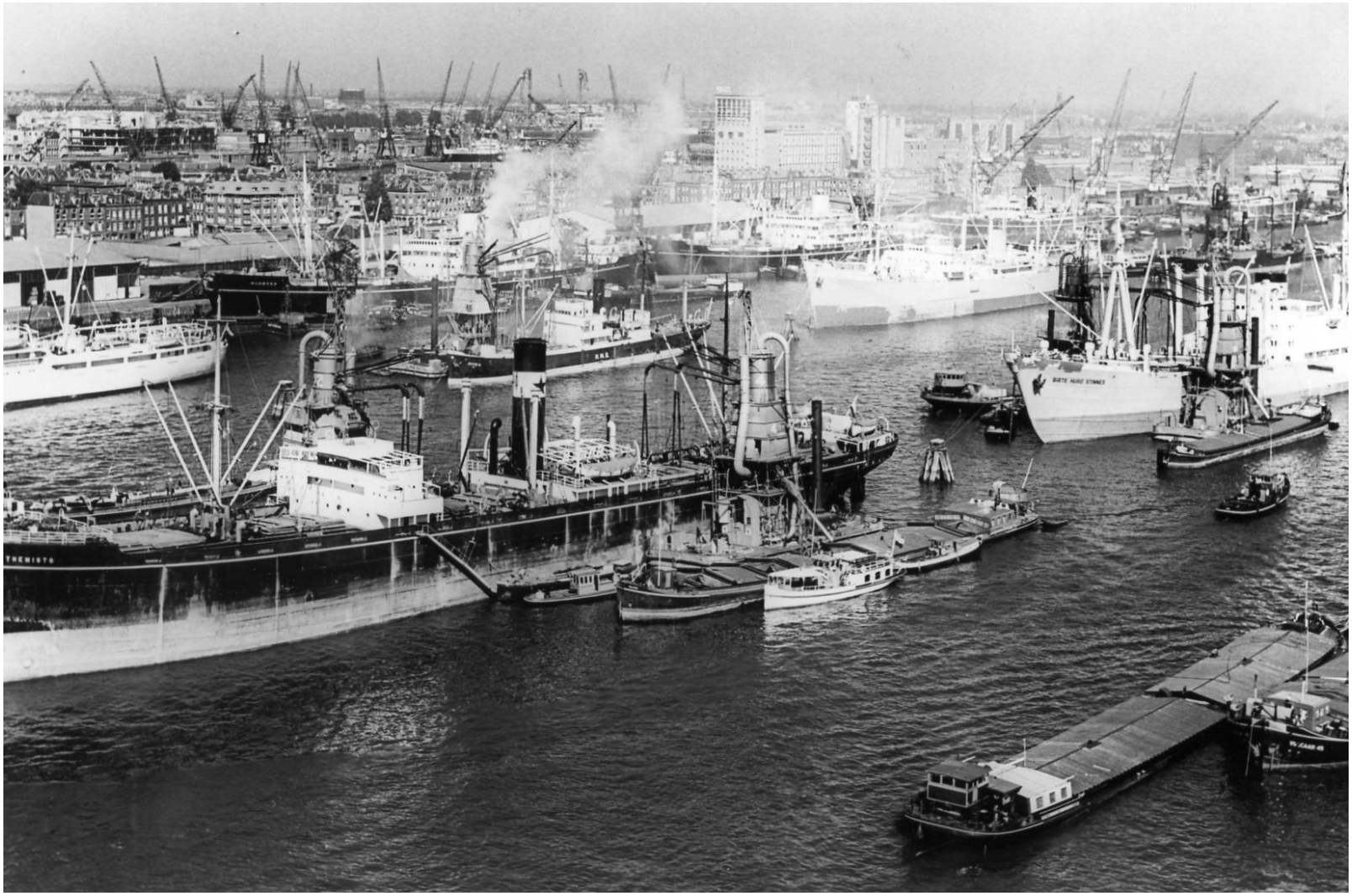

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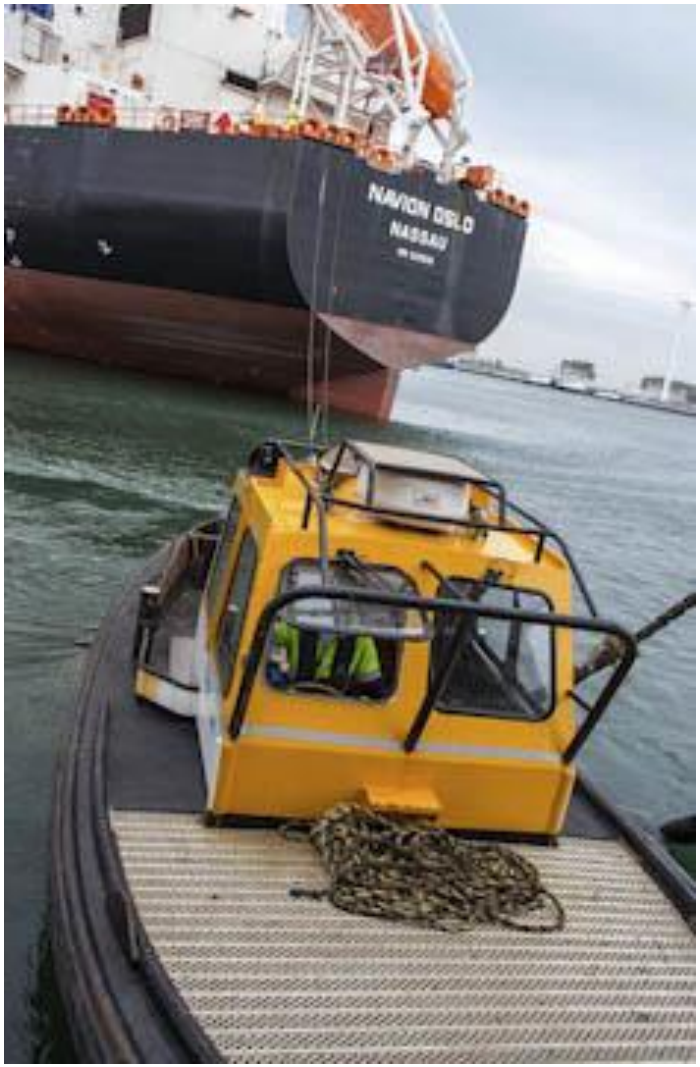

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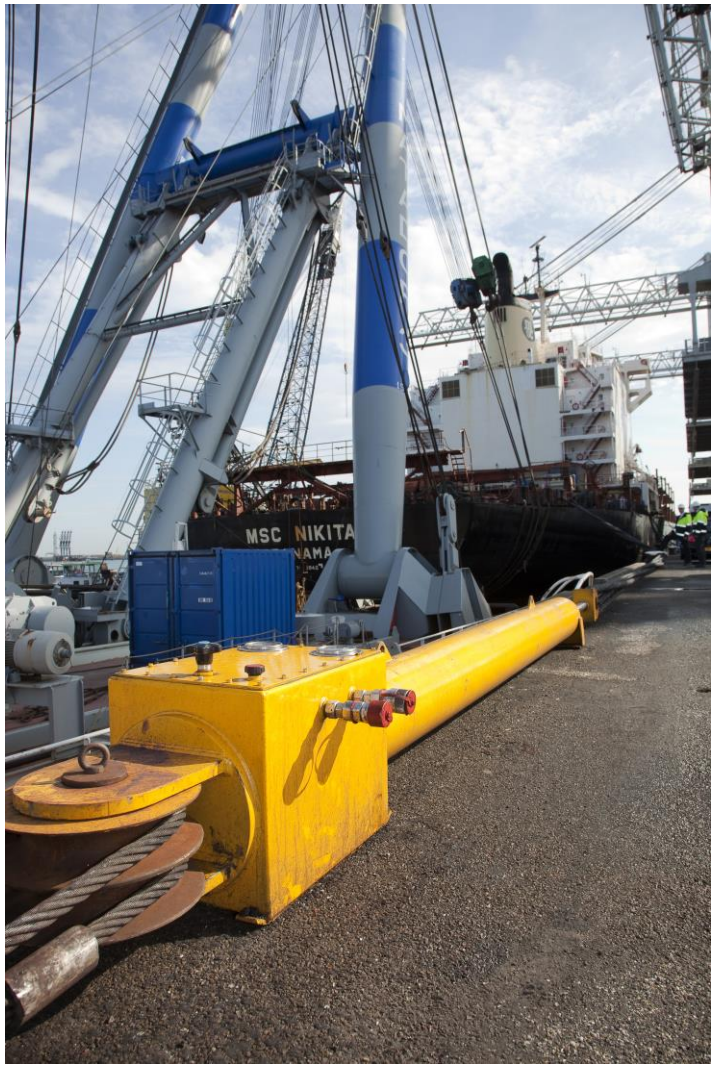

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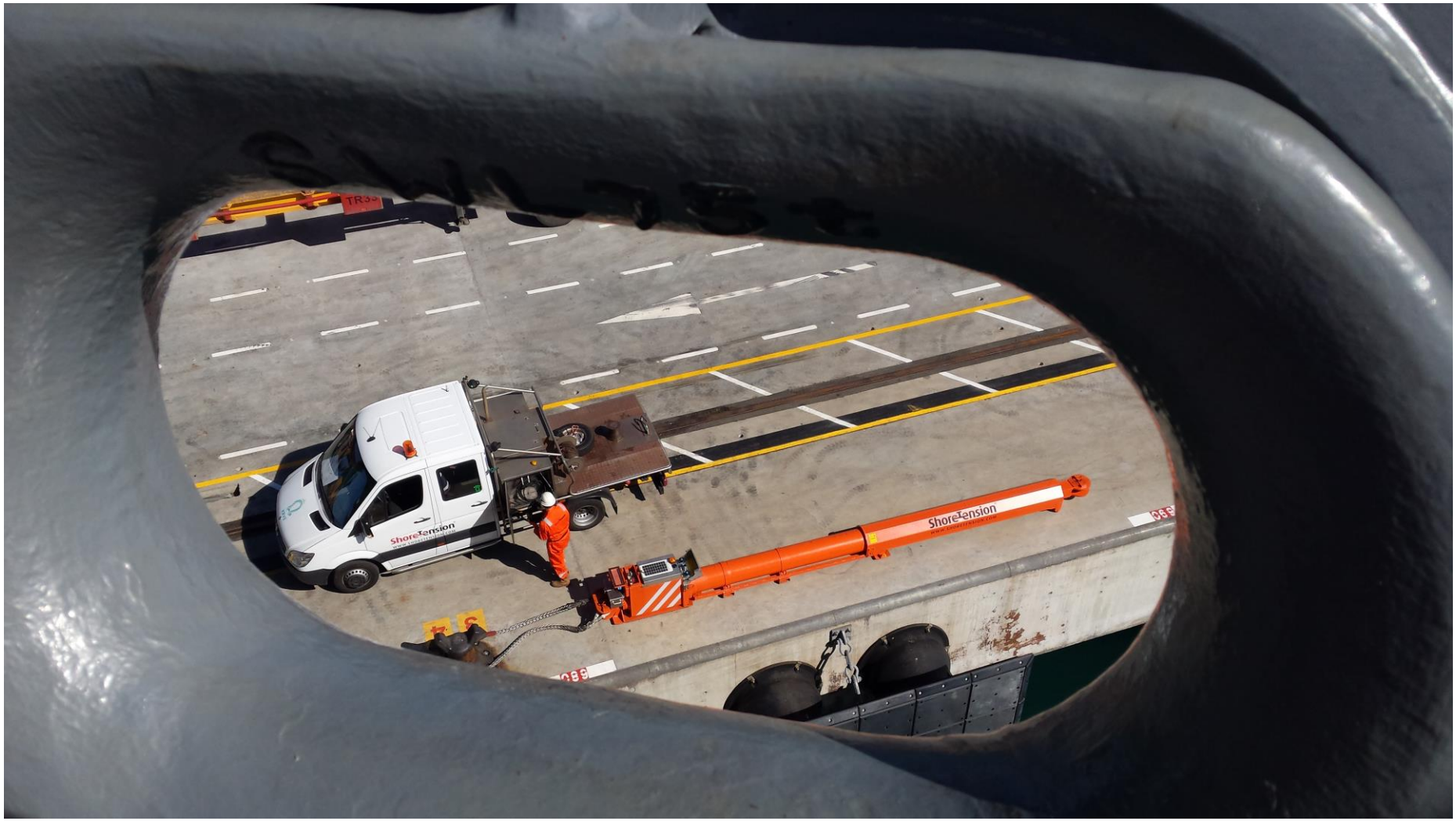

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EHMC Gdansk 2009

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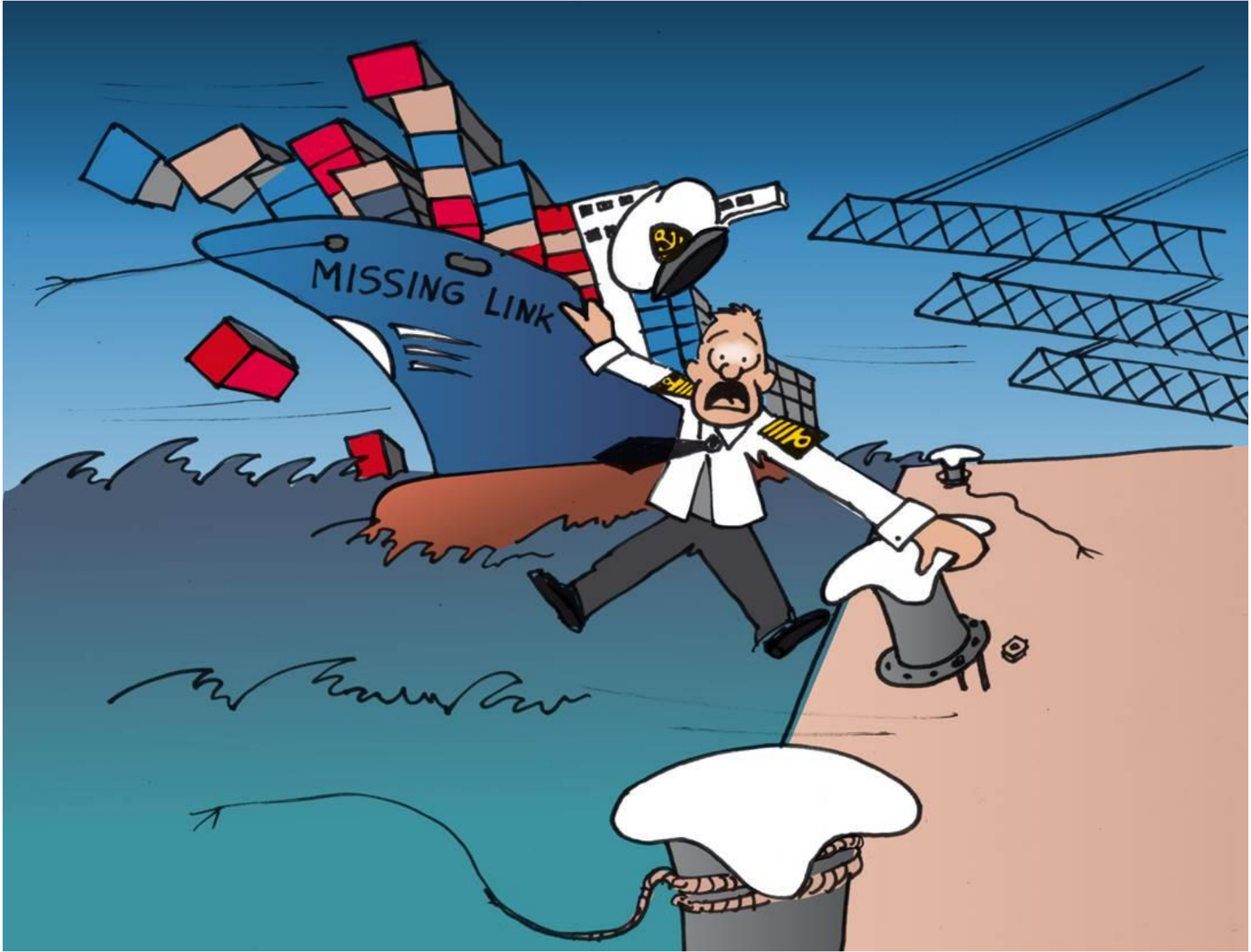
When innovation is triggered

- Rotterdam 18 January 2007
- Bft 10 storm
  - Mean hourly wind speed: 25 m/s
  - Strongest wind gust: 35 m/s
- Despite all precautions, Ms Claudel (34622 DWT) moored at ECT breaks out from its mooring lines and crashes into opposite Maasvlakte Oil Teminal.
- 1600 m^3 oil spil
- Estimated damage: over € 120 million


MISSING LINK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24-12-2012

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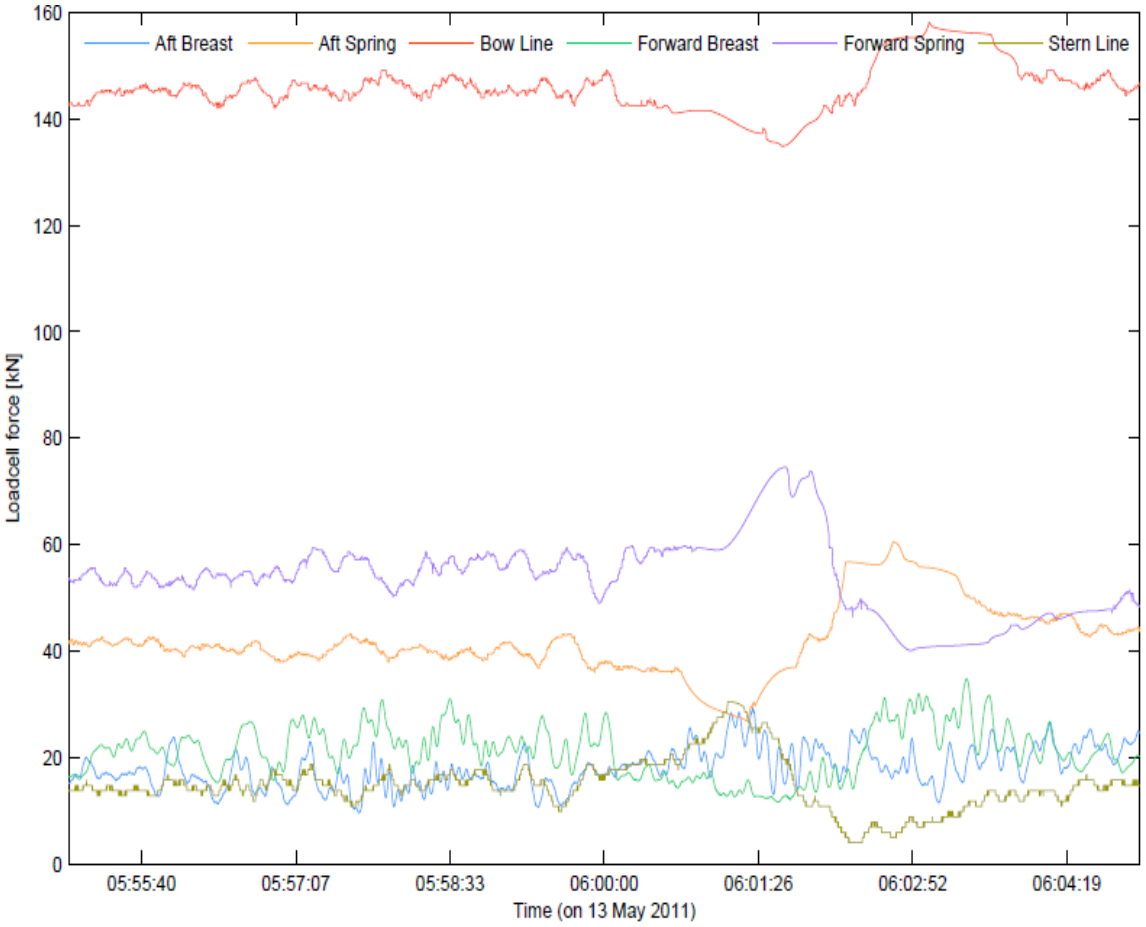
What happened?



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Mooring equipment

Certification?

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Acting together.

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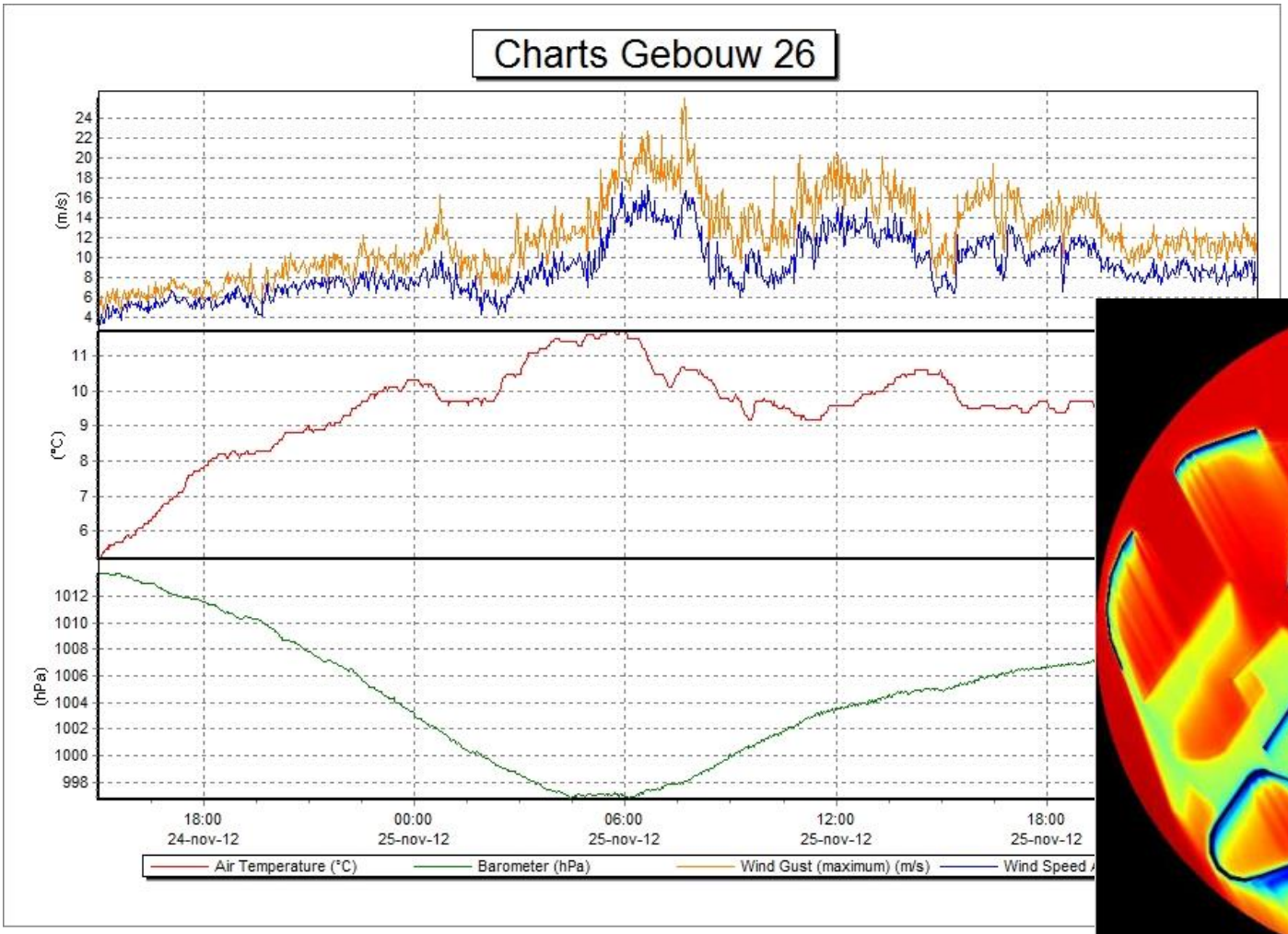
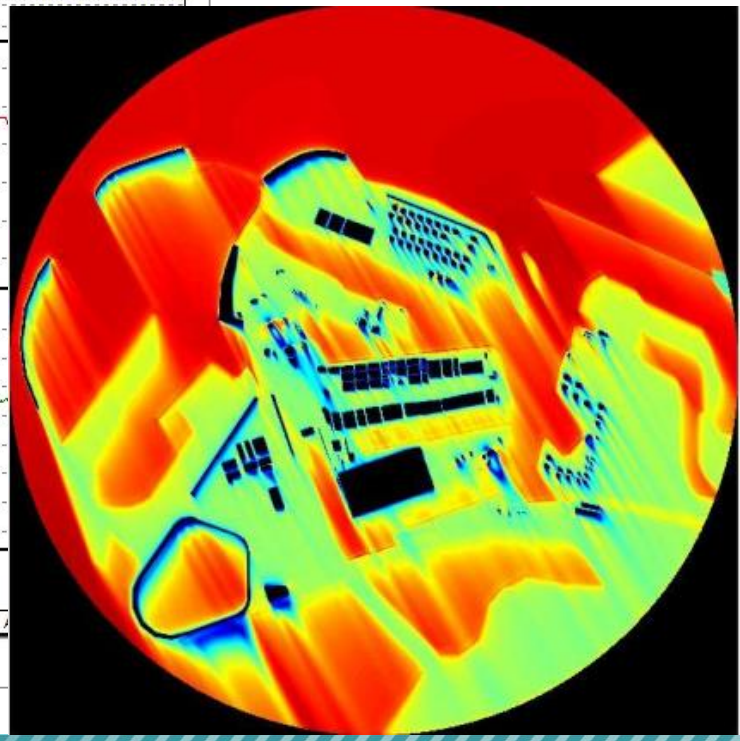
Weather conditions: Gale Force 10





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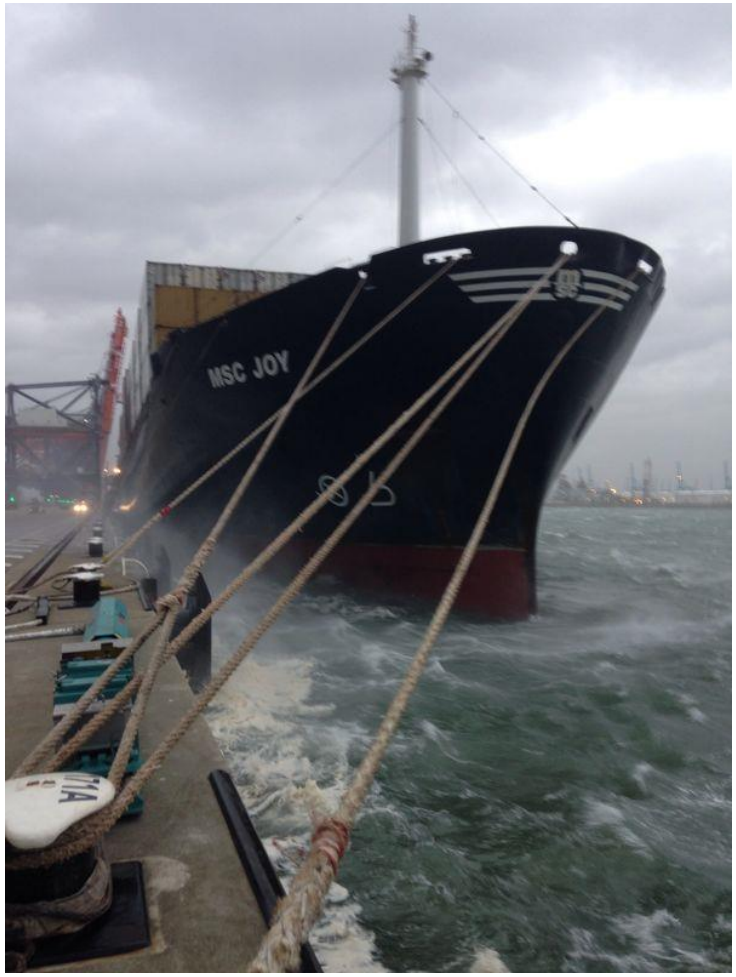
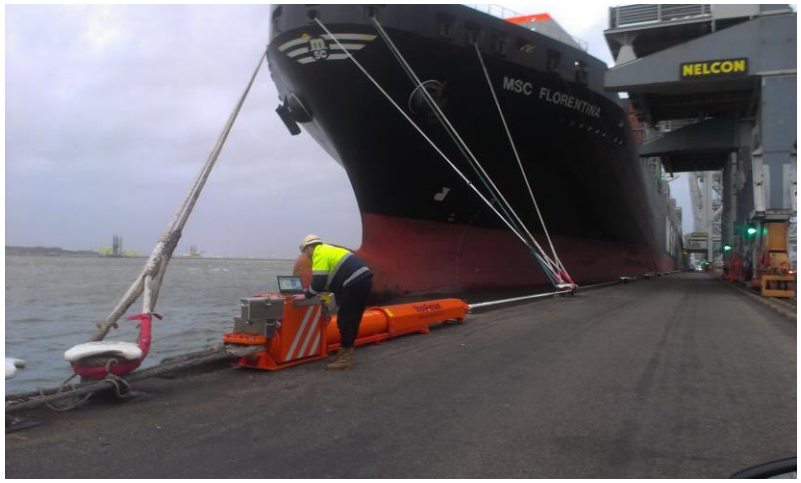
Mooring with ShoreTension®





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Mooring with ShoreTension®

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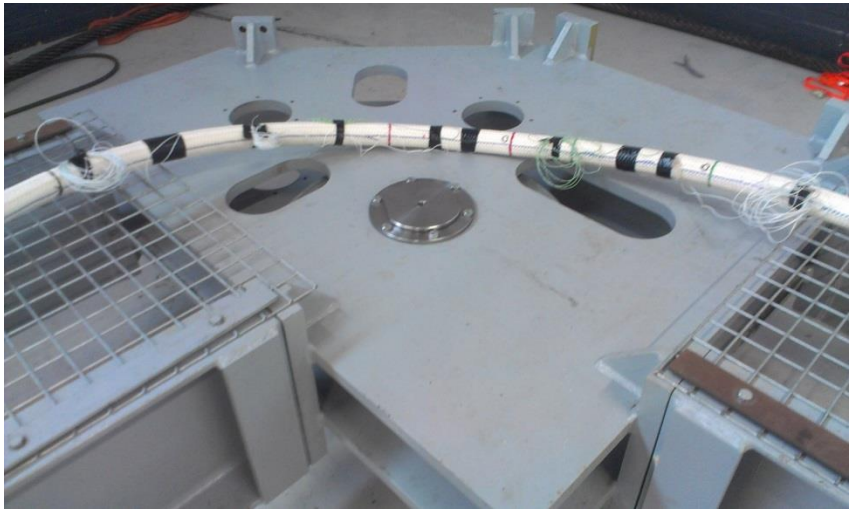
Rope technology – in house testing



Gleistein Ropes
The Perfect Line

Dyneema®
With you when it matters

DSM
BRIGHT SCIENCE. BRIGHTER LIVING.

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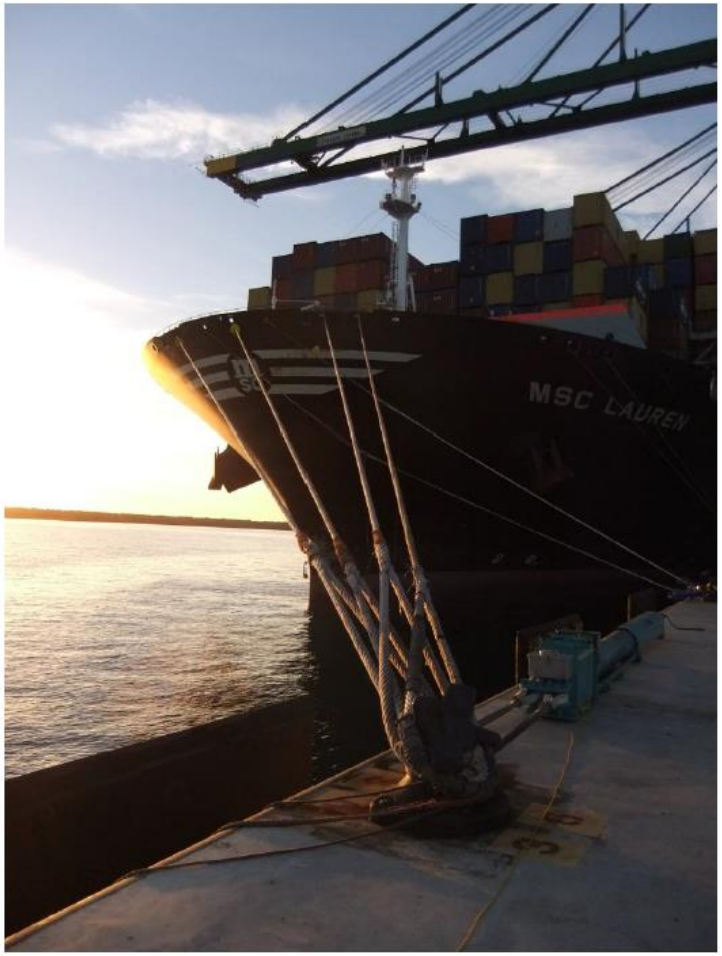
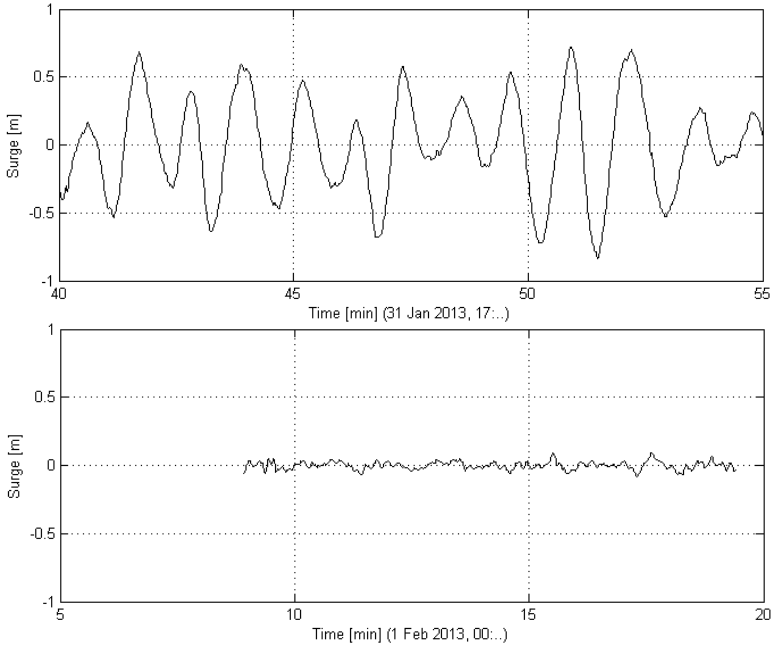
Full scale measurements; Sines, Portugal



Depending upon conditions:
Crane productivity increased with a maximum of 86% !



Royal HaskoningDHV
Enhancing Society Together

Royal Haskoning DHV develops a "DMA" program based on these results

X

Dynamic **M**ooring **A**nalysis

Tool by Royal Haskoning DHV, Deltares & TU Delft

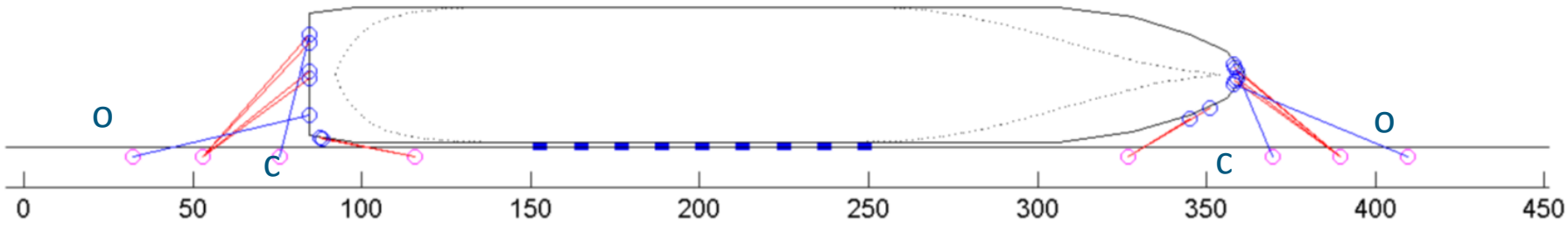
TU Delft Delft University of Technology

Royal HaskoningDHV *Enhancing Society Together*

Deltares Enabling Delta Life

Mooring arrangements

- Conventional ——————
  - 12 mooring lines
    - 4 bow lines
    - 2x2 spring lines
    - 4 stern lines
- ShoreTension: ——————
  - Conventional +
  - 4 ShoreTension
    - 2 swell chambers open (**o**)
    - 2 swell chambers closed (**c**)



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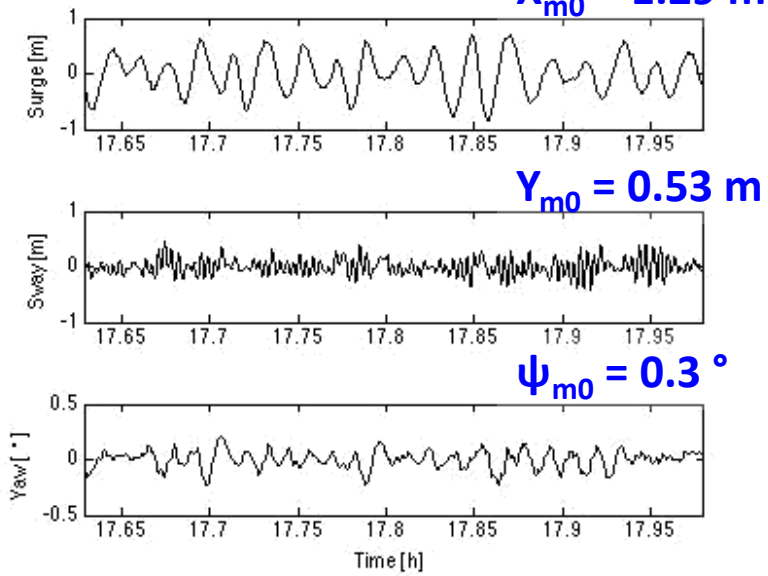
MSC Adriatic

- Surge (x), sway (y) and yaw (ψ) motion time series

Conventional mooring

X_{m0} = 1.29 m

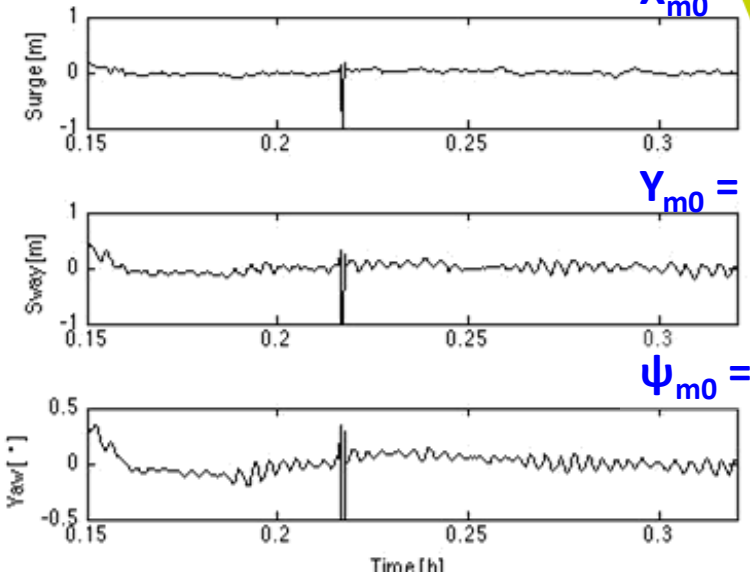


Y_{m0} = 0.53 m

ψ_{m0} = 0.3 °

ShoreTension mooring

X_{m0} = 0.05 m



Y_{m0} = 0.23 m

ψ_{m0} = 0.15°

Royal HaskoningDHV
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Deltares
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Projects

Spain - Port of El Ferrol
Long wave swell

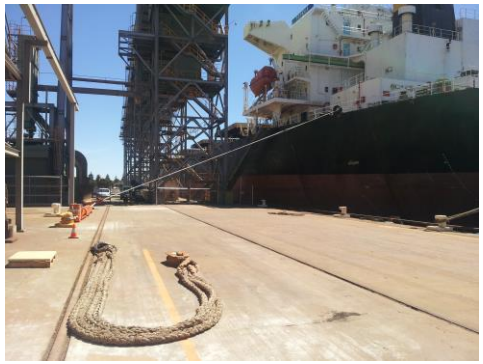
Rotterdam - Botlek
Heavy lift operation

Rotterdam - Europoort
Storm safety

Rotterdam - ECT
Storm safety

Benin - Cotonou
Long wave swell

Germany - Bremerhaven
Vessel positioning



Australia, Esperance
Long wave swell

Portugal - Sines
Long wave swell

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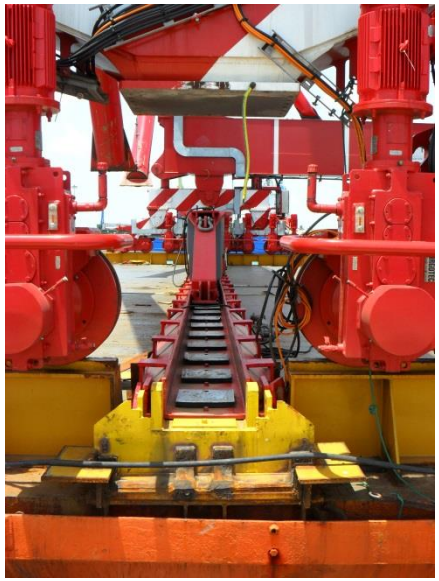
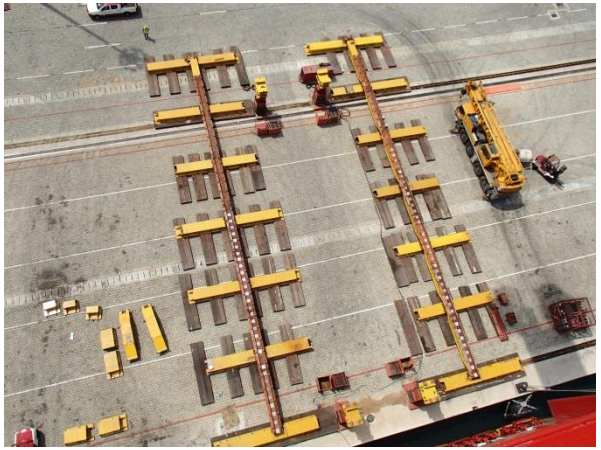
Offloading STS cranes in Cotonou, Benin





Surge motions decreased from 70cm to 4 cm!

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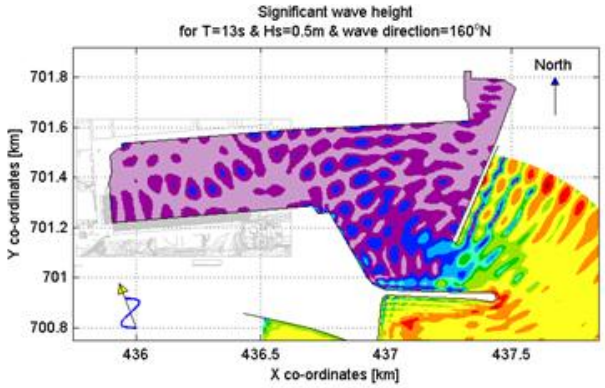
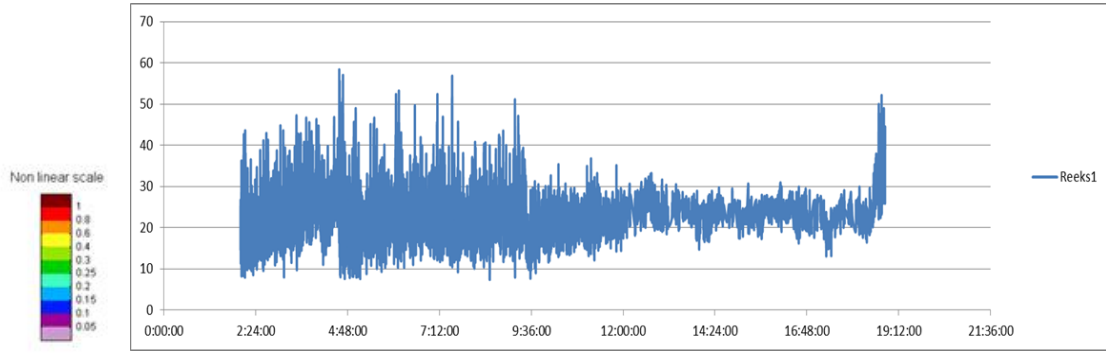
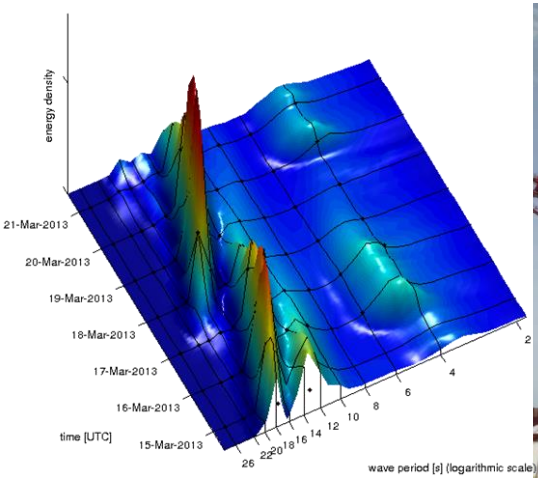
Offloading STS cranes in Cotonou, Benin [2]







X

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Developments

Open water ports:
- More Flexible expansions
- Increasing size of vessels
- Less impact on coast line
- Less dredging requirements

- MARIN Anounced a JIP focussed on Operations and Pro-Aactive Mooring in Heavy Ocean Swell

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Monitoring System


ShoreTension