AAPA Facilities Engineering Seminar and EXPO

Automating the mooring process

Mr. Ottonel Popesco, CEO Cavotec MSL & President of PEMA(Port Equipment Manufacturers Association)

CAVOTEC
Inspired Engineering

Automating the mooring process

Automating operational processes such as the mooring of ships is critical to sustain growth and continue expansion of port operations.

Key aspects to consider are:

1.Efficiency

2.Safety

3.Environment

4.Port infrastructure

5.Revenues

CAVOTEC
Inspired Engineering

Efficiency

CAVOTEC
Inspired Engineering

Automating the mooring process – MoorMaster

Automating the mooring process – *Efficiency*

Comparing traditional methods with automated mooring

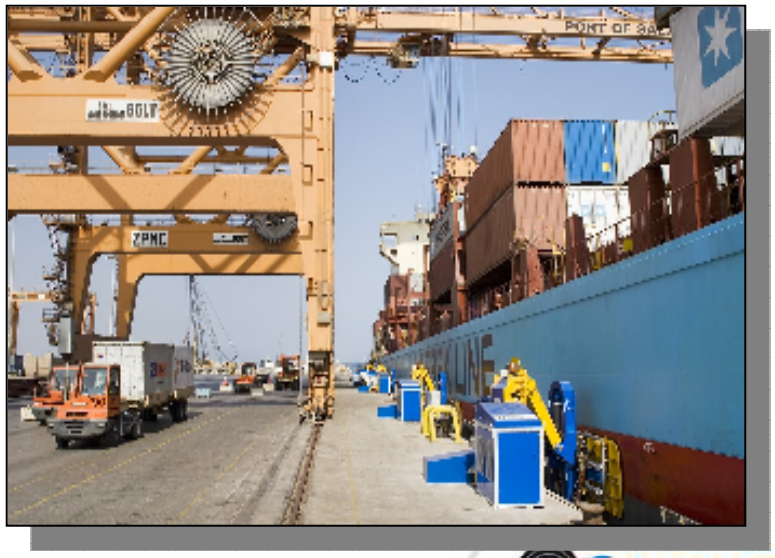
Way	Type	People involved	Time in min.	Motion control	Berthing position
Old	Ropes on onshore bollards	9-12	20-60	Semi-automatic	Flexible
Traditional	Ropes on Quick Release Hooks	9-12	20-60	Automatic	Flexible
Semi-Automatic	Ring or wire on onboard bollard	1-2	1	None	Fixed
Automatic	Vacuum pads	1	0,5	Automatic	Flexible

CAVOTEC Inspired Engineering

Automating the mooring process – *Efficiency*

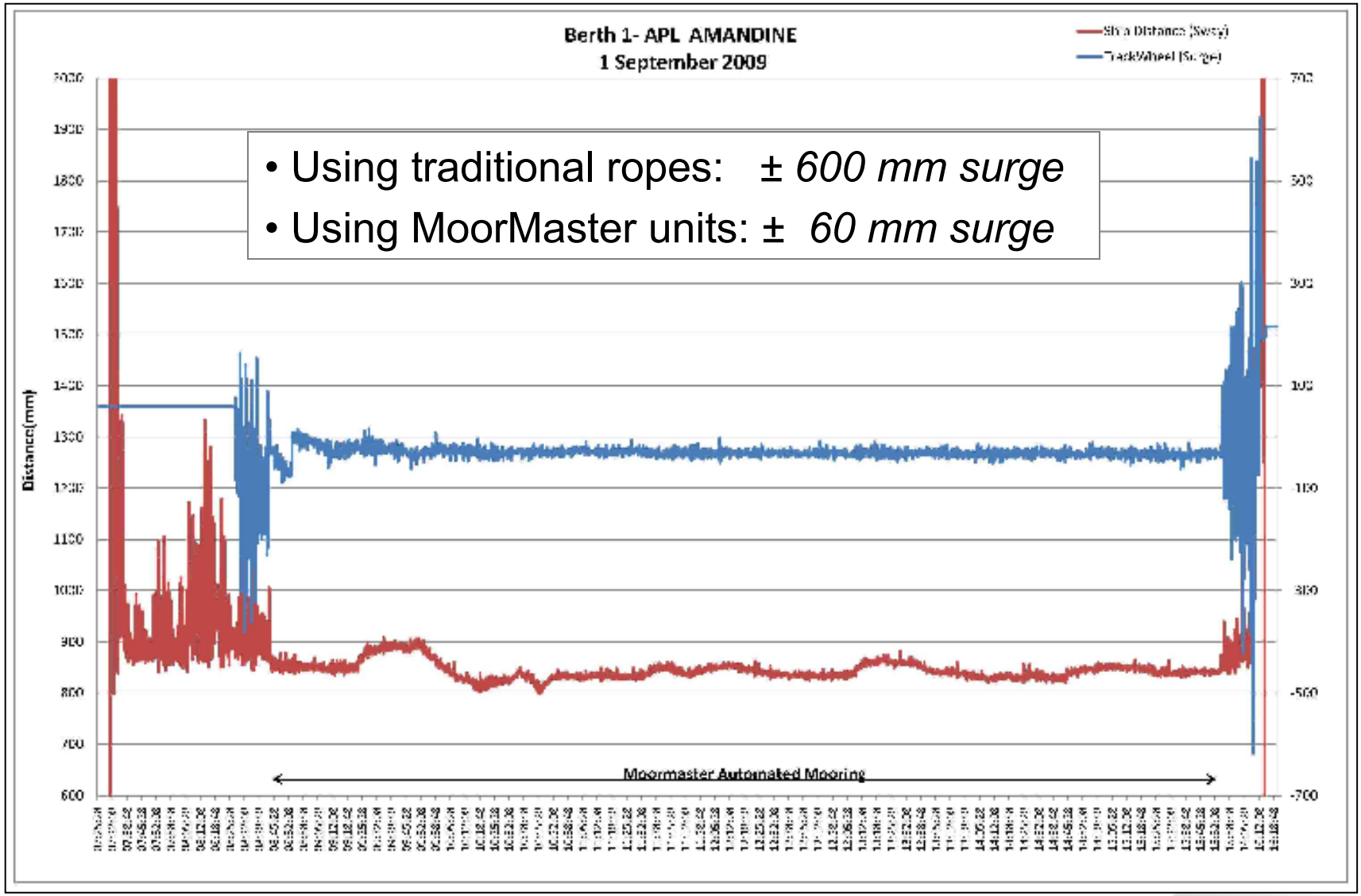
By reducing mooring time by **30 minutes** together with offering full surge monitoring capabilities, automated mooring systems are able to offer:

1. improved (faster) cargo handling operations
2. better terminal utilization through overhang of end berths
3. pilots & tugs can be used more often
4. shorter waiting time
5. shorter port stays



CAVOTEC
Inspired Engineering

Automating the mooring process – *Efficiency*

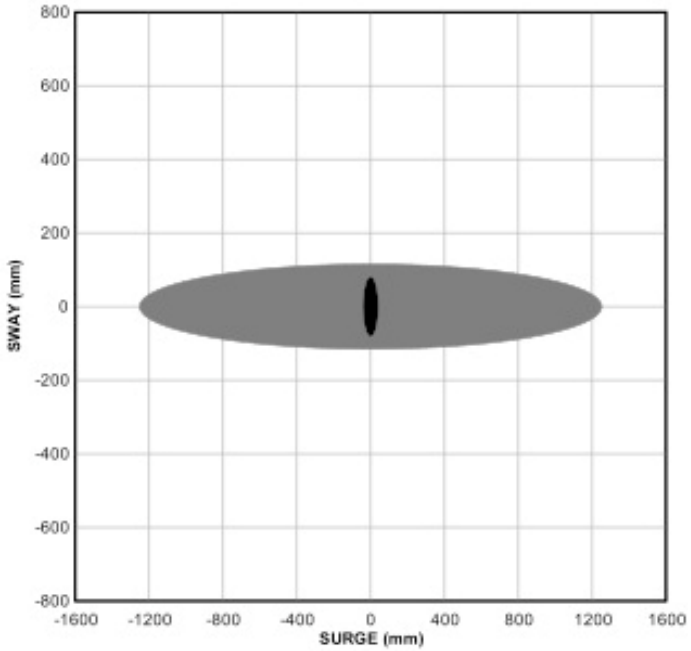


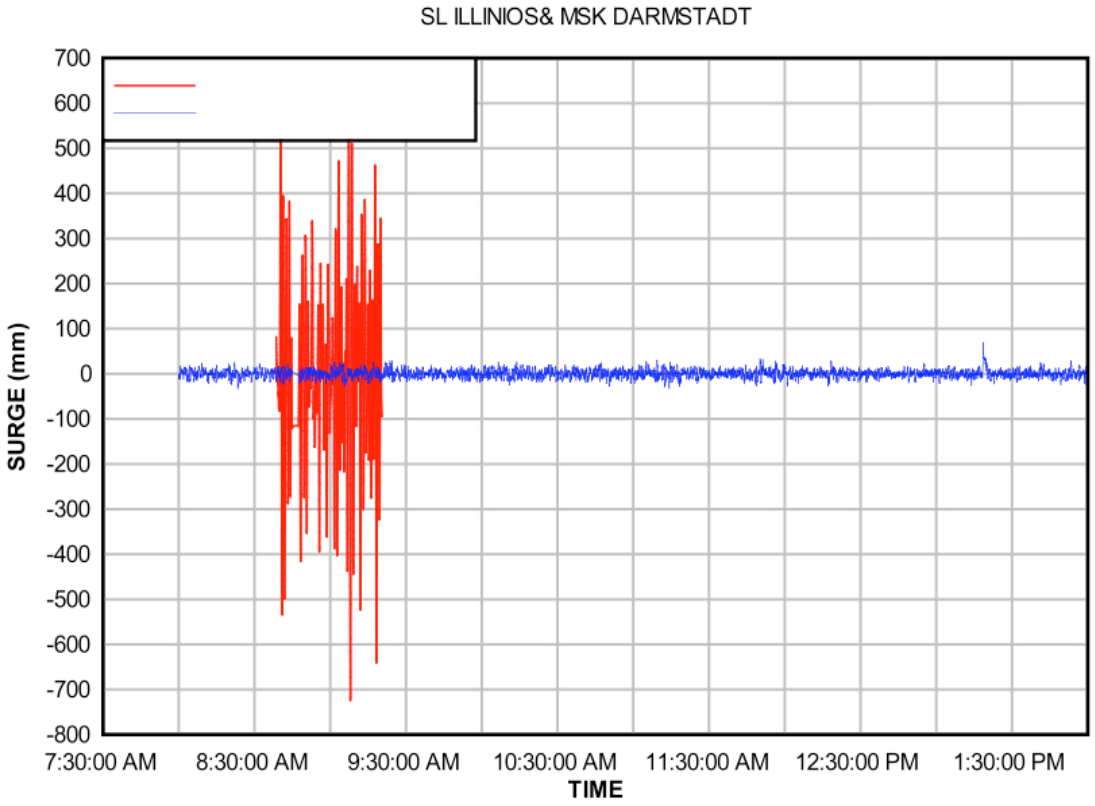
- Using traditional ropes: ± *600 mm surge*
- Using MoorMaster units: ± *60 mm surge*

CAVOTEC
Inspired Engineering

Automating the mooring process – *Efficiency*

Motion of a container **as a driver sees it** during typical long wave surging when held by the MoorMaster systems.





CAVOTEC
Inspired Engineering

Automating the mooring process – *Efficiency*

Automating the mooring process – *Efficiency*

MoorMaster avoids any equipment manhandling and needs just one person to attend the mooring operation.

This can be done from shore or on-board the ship via radio remote control.

CAVOTEC
Inspired Engineering

Safety

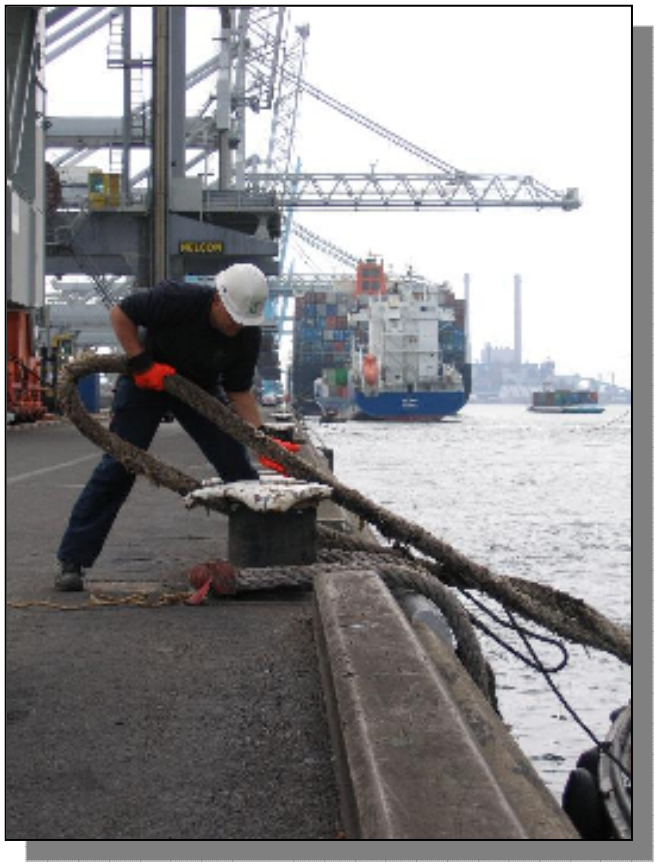
CAVOTEC
Inspired Engineering

Automating the mooring process – *Safety*

During everyday port operations personnel face many different hazards from varying sources. Regarding mooring these hazards can be classed as follows:

1. **Hazards during mooring operation**
   - Parted ropes/wires
   - Non-parted ropes/wires
2. **Ship drifting caused by:**
   - Wind
   - Passing vessel
   - Waves/surges
3. **Movement during cargo operations**

- Damage to the ship hull
- Damage to the cargo
- Damage to cargo handling equipment

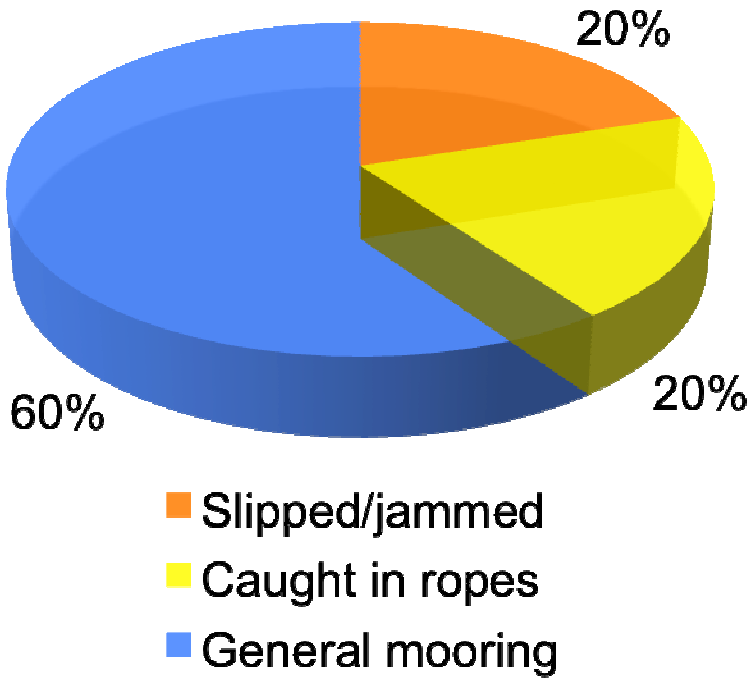


CAVOTEC
Inspired Engineering

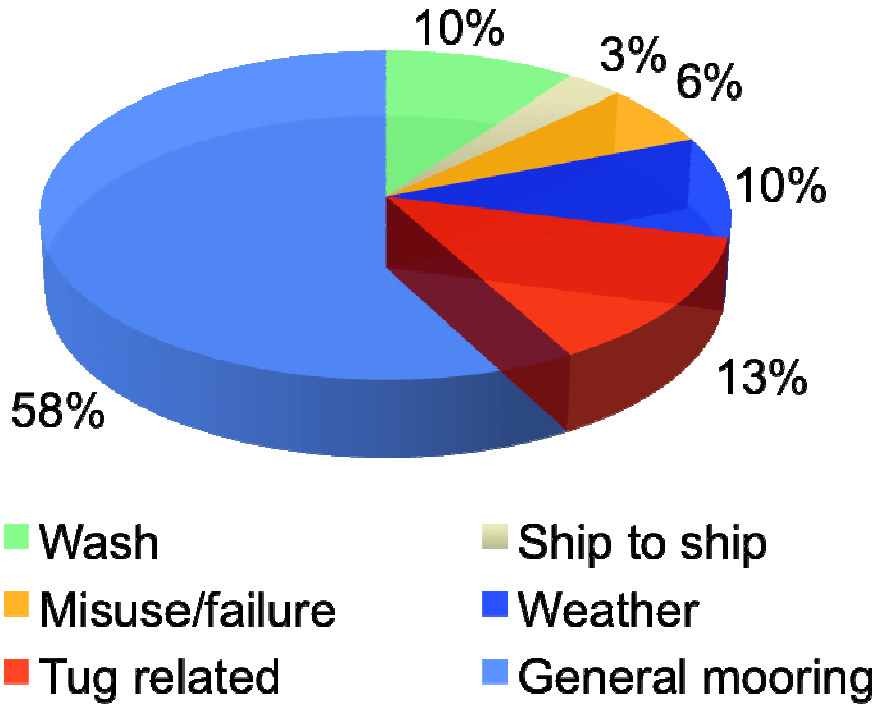
Automating the mooring process – *Safety*

The accident rate for direct port related businesses is estimated to be 1.2 per 100 employees on average, annually (1.2 per cent). Mooring remains one of the most dangerous operations*

Hit by non-parted ropes



Hit by parted ropes

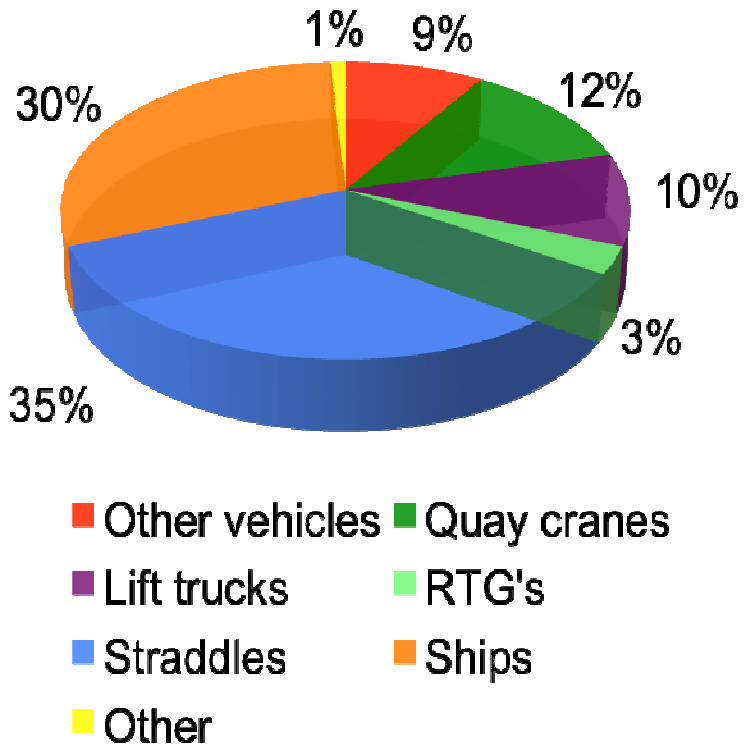


Source: UK P&I CLUB - LP News – 01/2009

CAVOTEC Inspired Engineering

Automating the mooring process – *Safety*

In ports, 30% of the total cost of claims, due to human errors, are caused by ship running into wharf and occasionally hitting quay cranes. This needs to be addressed by implementing better berthing/de-berthing procedures*



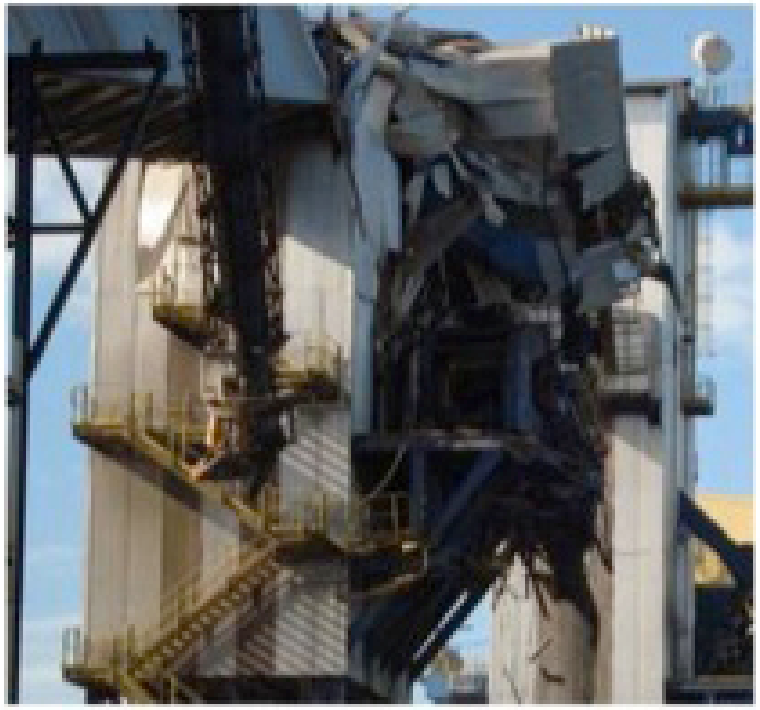
(*) Source: ICHCA International Biennial Conference 2008
"Safety and loss prevention in container terminal operations" - TT Club

CAVOTEC
Inspired Engineering

Automating the mooring process – *Safety*

Zhen Hua 27 broke her moorings in storm

The heavy load vessel **ZHEN HUA 27**, was berthed at TECON Terminal (TC1 point - on left margin of port) in Santos, São Paulo (Brasil) , to discharge 3 quayside container cranes, when at 03:30pm high winds (90km/h) blowings and broke her mooring, she ran adrift and floated towards port channel.



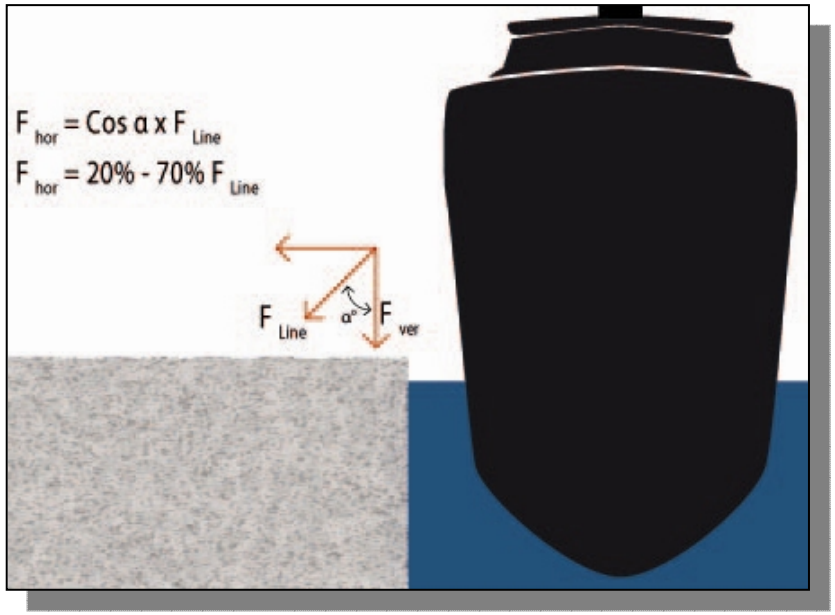
Out of control, the vessel crashed against the tanker (bunker) **AMALTHIA** (IMO: 9396294) that was supplying oil side by side oil of **Zhen Hua 27** (no big damages), and then she crashed against TGG´s terminal and bulk carrier **KYLA** (IMO: 8000460) berthed at TGG Terminal also causing subsential damages at her stem. The Brazilian ports authorithies will be investigate this casualty.

CAVOTEC
Inspired Engineering

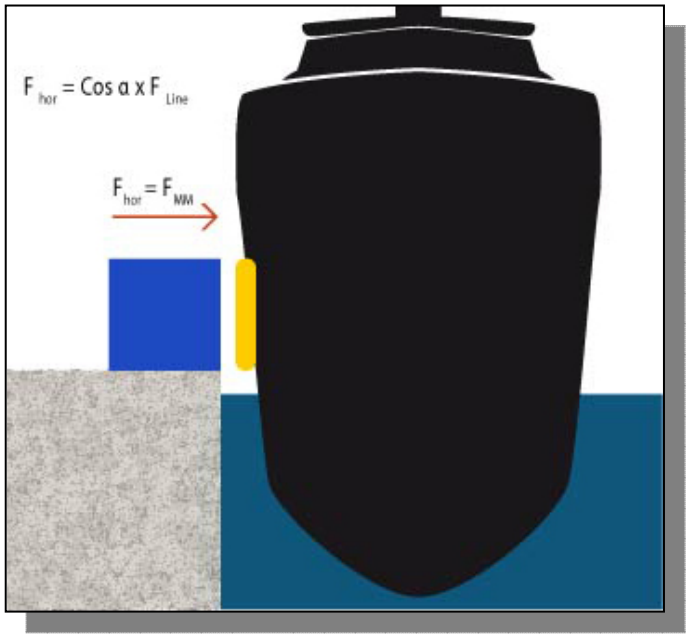
Automating the mooring process – *Safety*

- Ropes are inefficient and unsafe due sharp placement angles
- MoorMaster acts “normal” to the ship and is therefore, 100% reliable
- MoorMaster only reacts to forces applied to the ship and doesn’t allow it to accumulate energy

Calculation of forces
mooring ropes



Calculation of forces
MoorMaster



CAVOTEC
Inspired Engineering

Automating the mooring process – *Safety*

Tto guarantee complete control and security at any time, all MoorMaster functions are controlled by a state-of-art PLC.

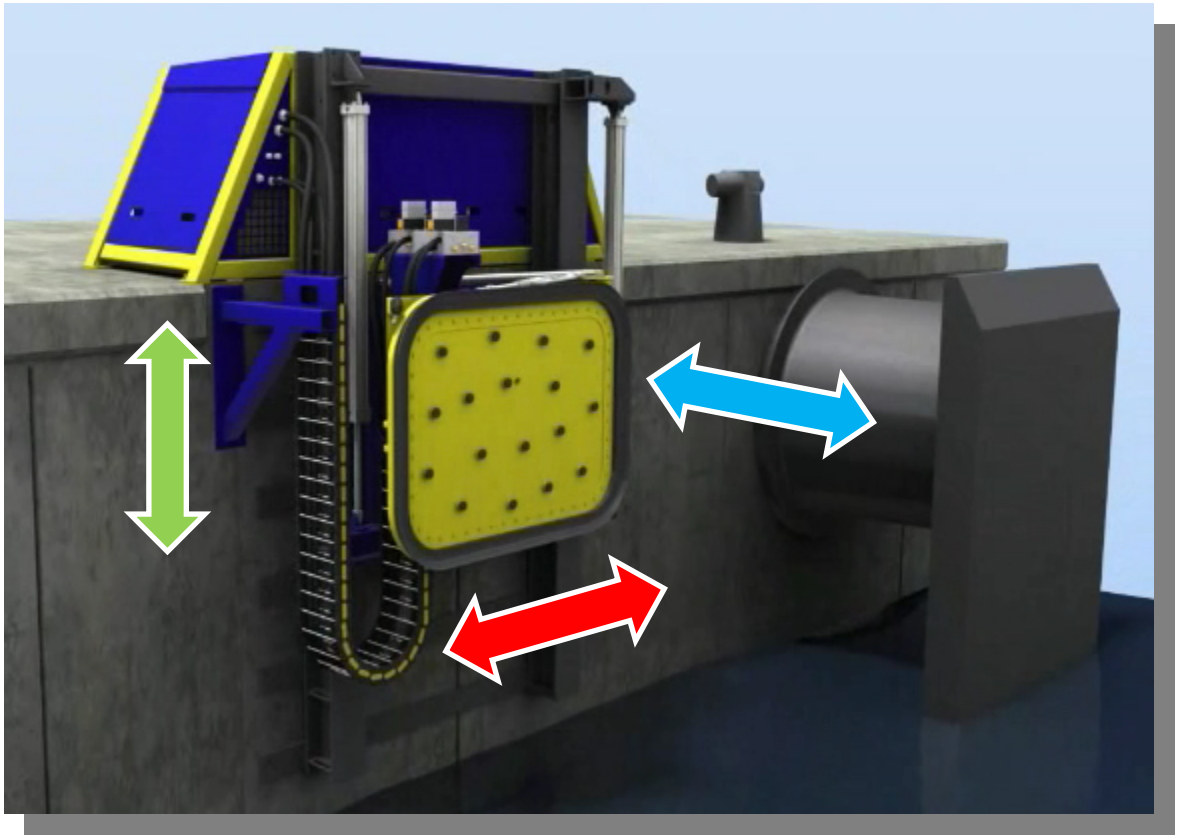
Tto ensure operators are fully aware of the status of the mooring, continuous load monitoring and sophisticated alarm functions are relayed in real time to the control unit.

CAVOTEC Inspired Engineering

Automating the mooring process – *Safety*

The MoorMaster uses a vacuum couple which is a proven technology and has shown itself to be extremely safe and reliable.

Any overload situation will result in gradual, non-destructive sliding motion of pads thereby eliminating the risk of mechanical damage.



Free movement

Extend, attach & hold

Reposition & restrain movement

CAVOTEC Inspired Engineering

Environment

CAVOTEC
Inspired Engineering

Automating the mooring process – *Environment*

Ports around the world are looking to ways further reduce their carbon footprint and overall impact on the environment. Automated mooring can support this by facilitating the following issues:

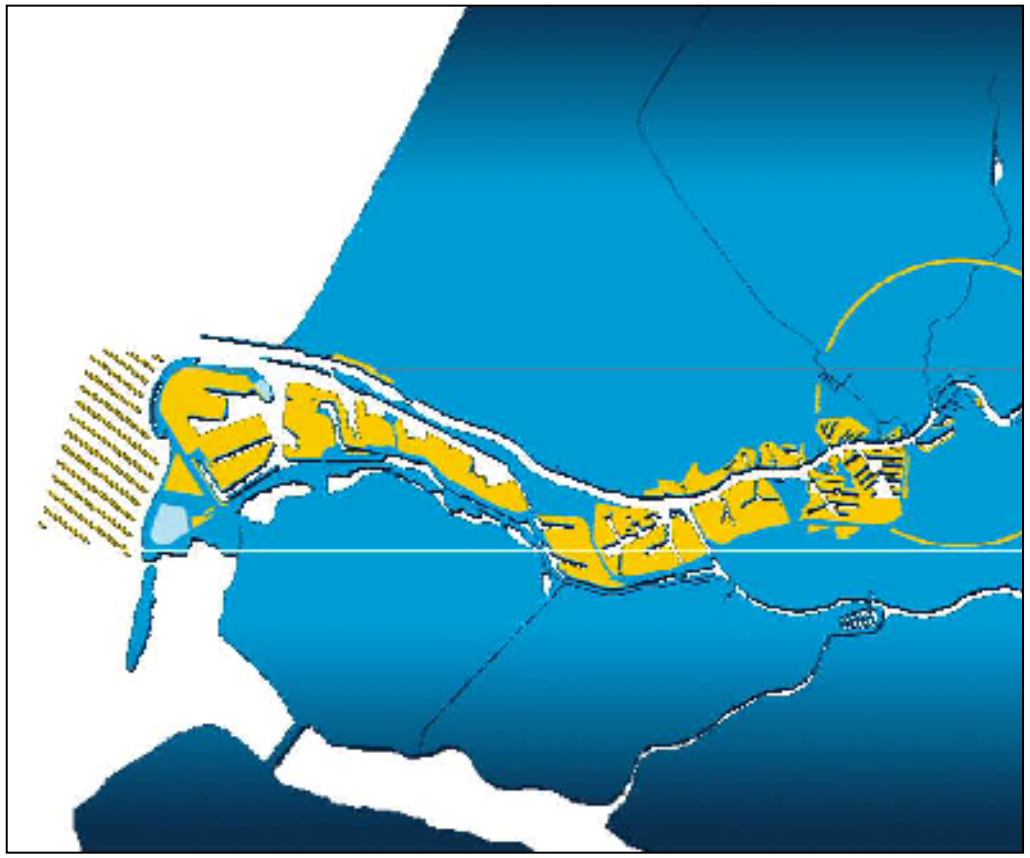
1. **Significantly shorten the mooring process and port stay**

1. **Permit a faster electrical shore connection of ship**

3. **Shorter tug use**

CAVOTEC
Inspired Engineering

Automating the mooring process – *Environment*



Source: DCMR Environmental Protection Agency, Studie luchtkwaliteit in Rijnmond (1994-2004)

Particle Matter (PM10)

as per 1-1-2005

year average < 40 µg/m3

day avg. of 50 µg/m3 : < 35 days

Nitrogen dioxide (NO2)

as per 1-1-2010

year average < 40 µg/m3

hour avg. of 200 µg/m3: <18 days

Red = Not Compliant

Source: IAPH Meeting, Riga 2006

CAVOTEC Inspired Engineering

Infrastructure

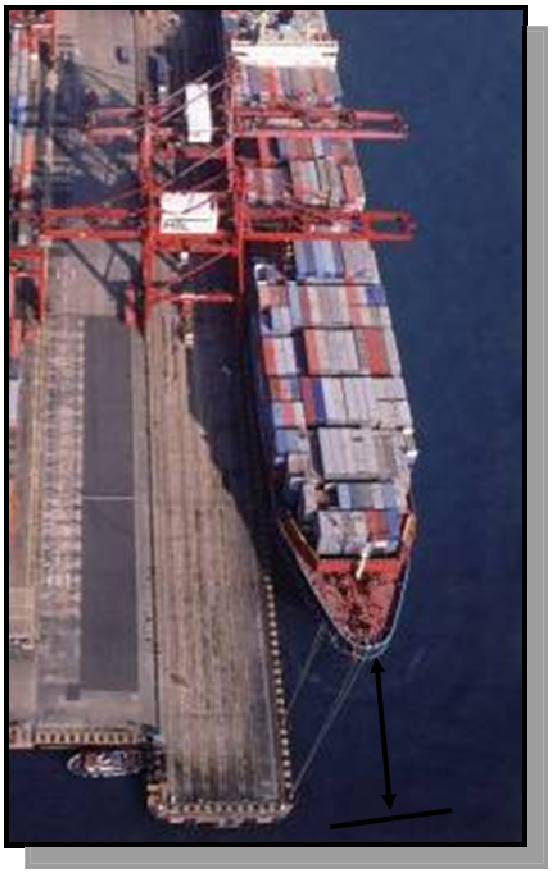
CAVOTEC
Inspired Engineering

Automating the mooring process – *Infrastructure*

Automated mooring can provide the following benefits regarding port infrastructure:

1.Elimination of non productive berth areas
•in-between ships
•at end of quay

2.Virtual Quay
•no need for dolphins/quay expansion



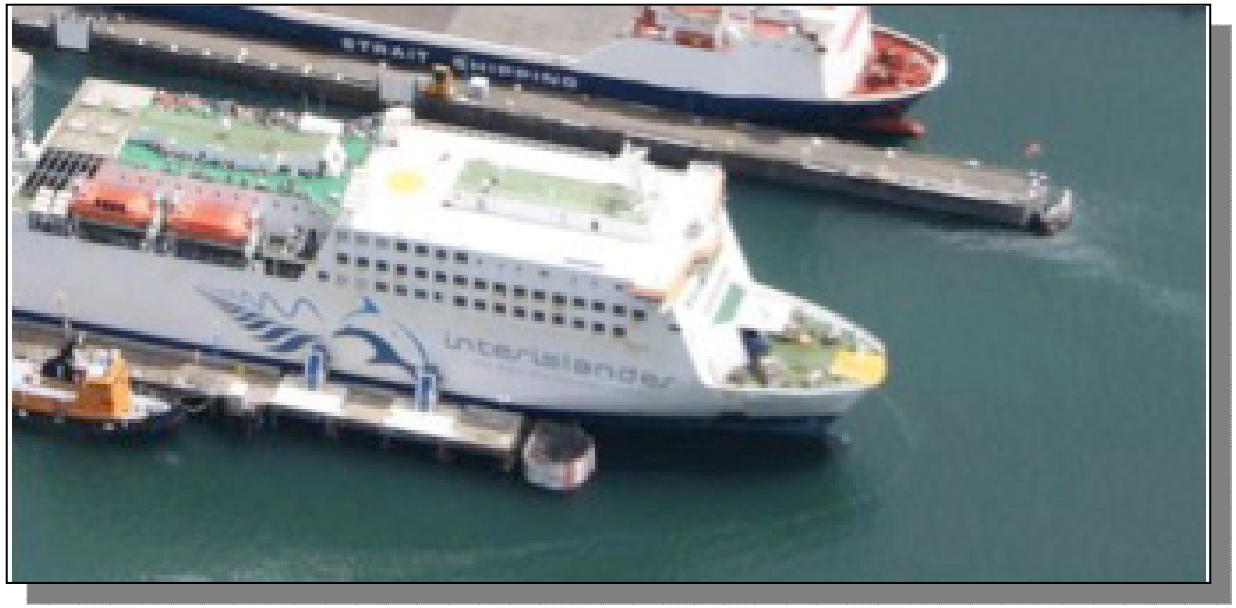
CAVOTEC
Inspired Engineering

Automating the mooring process – *Infrastructure*

Extending the quay or installing breakwaters are extremely expensive undertakings.

By using automated mooring systems:

3. **Vessels can overhang the berth**
4. **Reduced need for breakwaters**



CAVOTEC
Inspired Engineering

Savings

CAVOTEC
Inspired Engineering

Automating the mooring process – *Revenues*

Automated mooring system increases the STS crane productivity. Cost saving, due to the increased productivity, in a typical container terminal with 3 berths, can be estimated as follow:

• Crane movement per ship	5.000 Mov.
• Average movement per crane	35 Mov./h
• Total utilisation of crane per ship	142.8 h
• Total utilisation of cranes in terminal	44.571 h/year
• Increased STS crane productivity	5%
• Less utilization of STS cranes	2.122 h/year
• Cost of STS crane operator	125 USD/h
Savings per year	**265.000 USD**

(*) Berth utilization: 2 ships per berth per week – 52 weeks per year
(**) Average size of ships: 6.500 TEU

CAVOTEC Inspired Engineering

Automating the mooring process – *Revenues*

The total cost saving from automated mooring system in a typical container terminal with 3 berths, can be estimated considering at least 2**0 minute reduction of mooring time:**

• Less tug and mooring crew	+ USD 325.000
• MM maintenace cost	- USD 53.000
• Increased STS productivity	+ USD 265.000
Total savings per year	**+ USD 537.000**

(*) Calculations are made on per annum basis
(**) Berth utilization: 2 ships per berth per week – 52 weeks per year
(***) Average size of ships: 6.500 TEU

CAVOTEC Inspired Engineering

Automating the mooring process – *Savings*

Implementation of automated mooring systems in a port can typically result in **significant reductions in infrastructure expenditure**.

Average costs for typical infrastructure expansion are:

- 50m quay length extension USD 3.7M
- 1 Mooring Dolphin: USD 1.6M

CAVOTEC Inspired Engineering

References

CAVOTEC
Inspired Engineering

Automating the mooring process – *References*

MoorMaster automated mooring systems have been extensively tested and have proven themselves in the most extreme conditions found in **container ports:**

2009
Port of Salalah (APMT)

2006
Port of Salalah (APMT)

2005
Port of Salalah (APMT)

CAVOTEC
Inspired Engineering

Automating the mooring process – *References*

For use in **locks**, Cavotec designed a special version of the MoorMaster capable of extensive vertical travel. These units have been installed in:

2009
St. Lawrence Seaway – Canada

2006
St. Lawrence Seaway – Canada

CAVOTEC
Inspired Engineering

Automating the mooring process – *References*

MoorMaster systems are in use at several **RoRo and RoPax facilities** around the world:

2009
Nordic Ferry Services – Denmark

2005
Interislander Ferries – New Zealand

2002
Interislander Ferries – New Zealand

2003
Patrick Shipping – Australia

1999
RF “Aratere” – New Zealand

CAVOTEC
Inspired Engineering

Automating the mooring process – *References*

MoorMaster systems is on its way to be installed on **Large Bulk** applications:

2009/2010

Port Headland– Australia

CAVOTEC
Inspired Engineering

Automating the mooring process – *References*

MoorMaster systems is under specification for **ship to ship application:**

2008/2012

US Navy – USA

Various Oil companies : undisclosed

CAVOTEC
Inspired Engineering

Automating the mooring process – *References*

- Over 40 units of MoorMaster are under operation or installation since 9 years

CAVOTEC
Inspired Engineering

Thank you for your attention

For more information please visit
www.cavotec.com