



TopTier open meeting

8 April 2025

Time (CET)	Topic
09:00 – 09:30	<i>Registration & Coffee</i>
09:30 – 10:00	TopTier overview
10:00 – 10:40	Avoiding 'major off-design' container losses
10:40 – 11:00	Panel discussion
11:00 – 11:30	<i>Coffee break</i>
11:30 – 12:10	Avoiding 'modest in-design' container losses
12:10 – 12:30	Panel discussion
12:30 – 13:00	TopTier follow up pitches / Open floor
13:00 – 14:00	<i>Lunch</i>

Please note there are only limited seats available and that you can follow the meeting online as well ([zoom link](#)). Register at registrations.marin.nl/blueweek-2025

Venue: MARIN, Haagsteeg 2, 6708 PM Wageningen

For questions; Toptier@marin.nl

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BETTER SHIPS, BLUE OCEANS



TopTier open event

2025-04-08

2021 -> TopTier kick off



2021 ... Why, where, when, how many



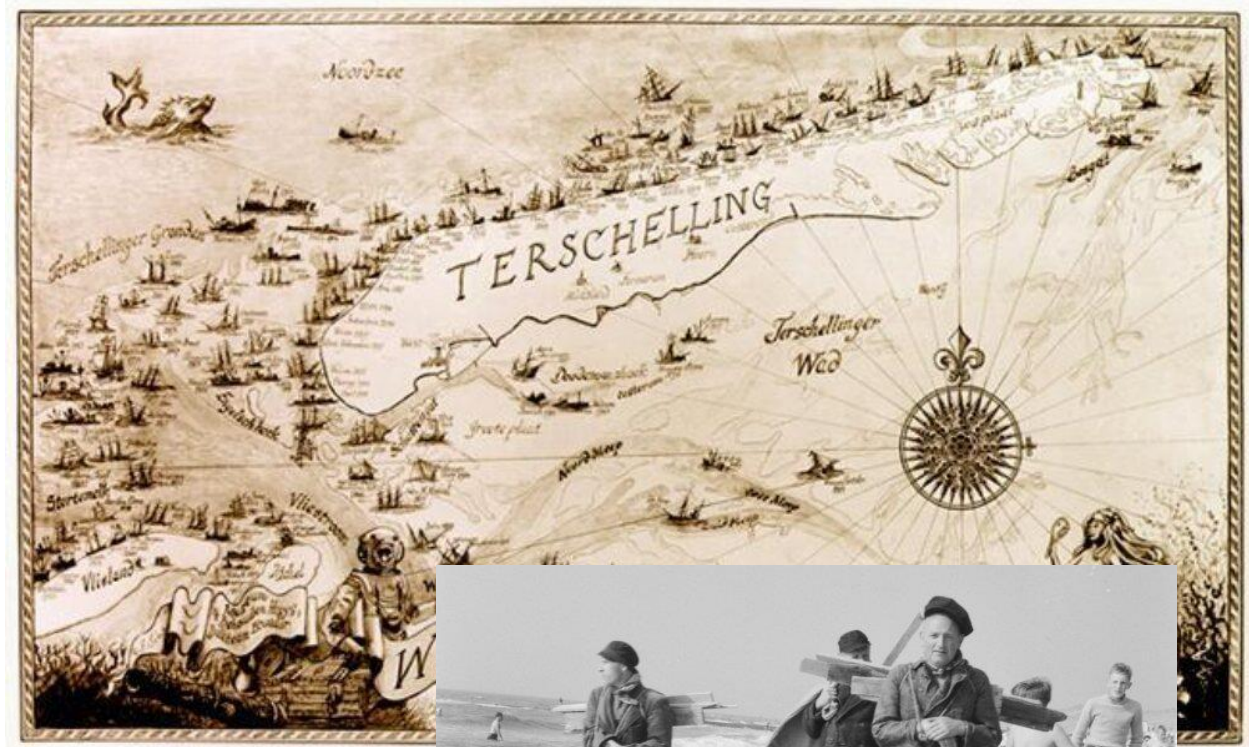
Lost 44 Containers



- Averaged 1482 per year (WSC)
- Fraction of 250.000.000 - But too high as absolute
- Public concern on safety standards in shipping

But not a new topic ...

- A long history
- Drama's at sea
- Cargo on beaches



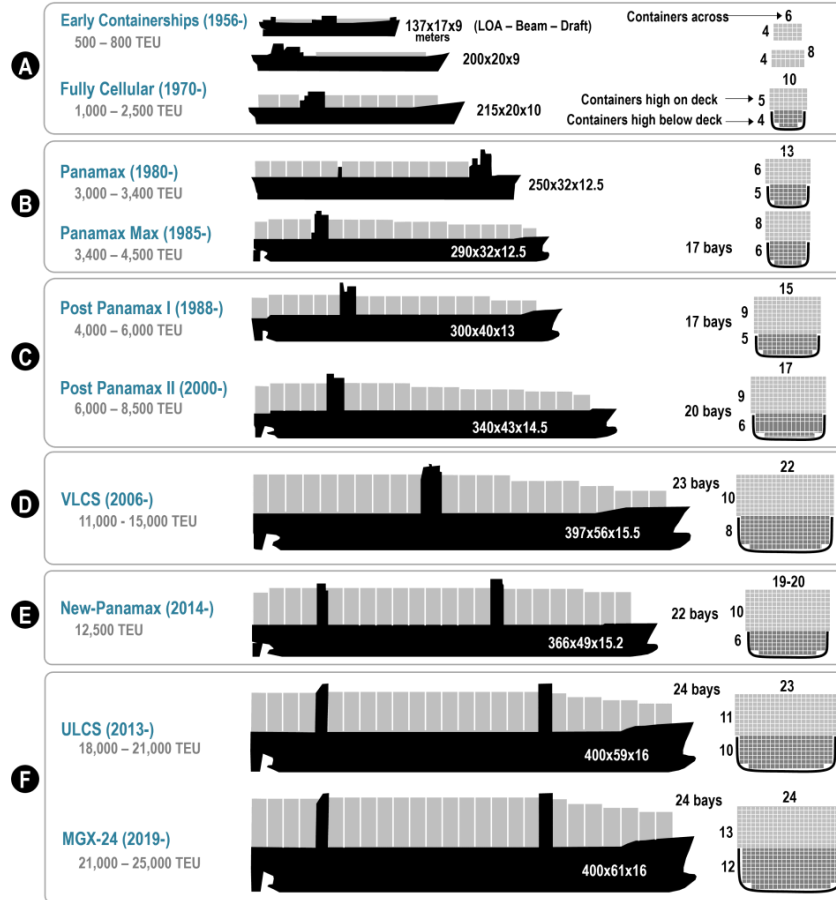
LASHING



NYK Argus (Post Panamax)

Mandatory verification of the gross mass (VGM) of packed containers
(IMO MSC session 17-21 November 2014)

Big increase in containership size in recent years



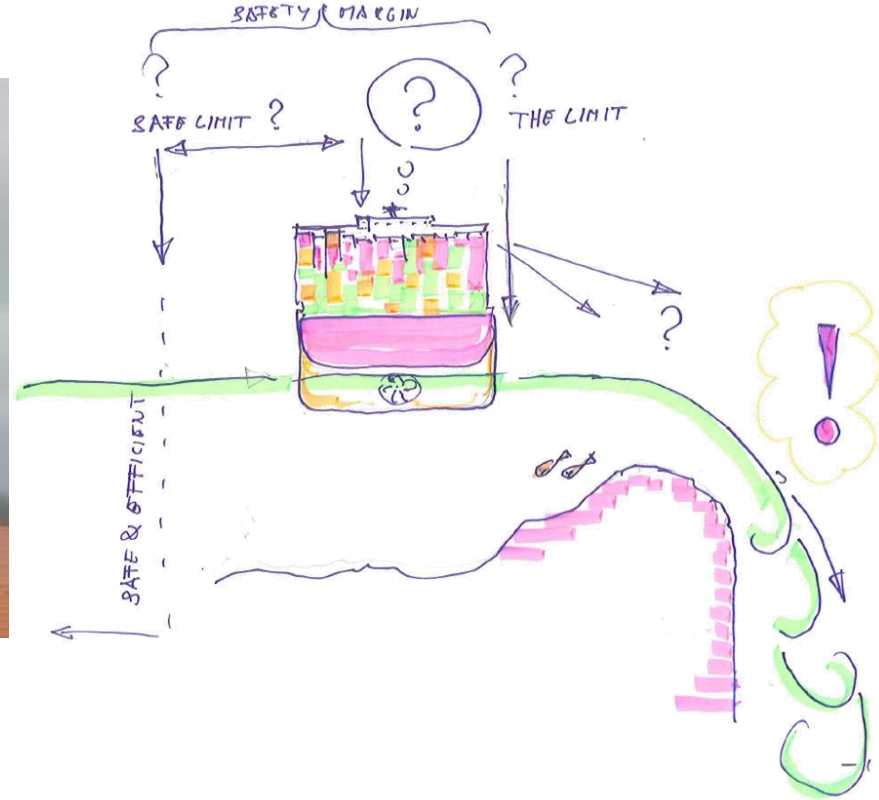
Lashing@Sea

Now !

Source: The Geography of Transport Systems

How are container ships safe ?

- Designed to be safely operable !



Have a “designed” (**fixed**)

- **Container capacity plan** -> max volume and types
- **Securing arrangement** -> safe working loads

Operational – day to day - practice :

- **Plan and load** max cargo that:
 - “safe working loads are not exceeded in **worst expected** conditions”
- **Operate** vessel that worst expected conditions are not exceeded
- **Inspect & maintain** containers and lashings for assumed strength

Safe cargo stowage & securing

Control ...



Long term maintenance & inspection

Voyage preparation

Cargo Info (VGM, DG) ..

Stow plan

Design Extreme motions

Design Extreme Loads

Limits (SWL)

I&M&R for combined strength

World Container fleet

Ships Lashing inventory

Operational stage

Route Weather Vessel Handling ...

Actual Stow

Transit motions

Transit Loads

Shore side input

stowage planning

Validate stow plan (Lashing computer)

Planning objective

I&M objective

Loading Objective

Transit Objectives

Forces <

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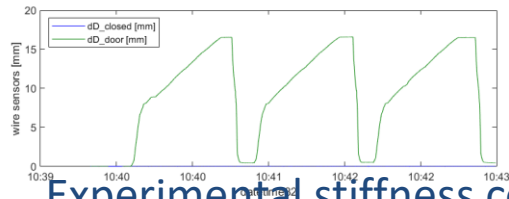
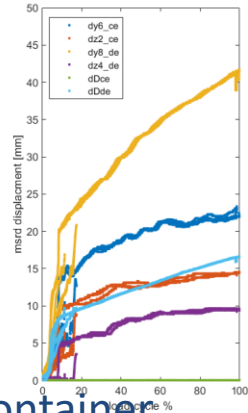
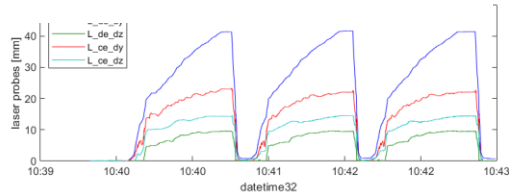
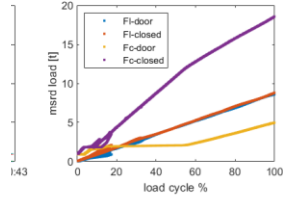
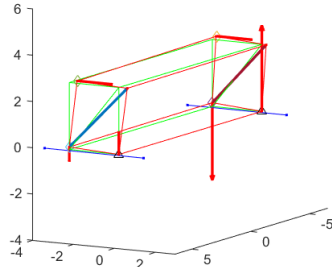
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- Review current practice
- Incidents and gap analysis
- Crew questionnaires
- On board surveys
- Terminal workshop
- Strength testing lashing – container equipment
- Model tests extreme rolling
- Large motion bridge simulator tests parametric roll
- On board measurements
- High tier stack model test campaign MTI
- Evaluation of high fidelity and operational solvers
- Container flexibility measurements
- Many discussions on legislation around CSS
- ...

INTERNATIONAL DARD

ISO
668

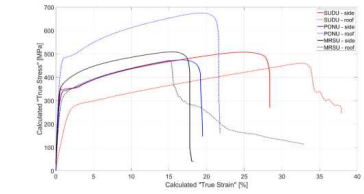
24-10-09 10:39 - TL_locked / loading DE+CE



Experimental stiffness container

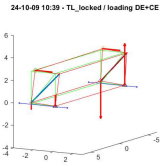
background and summary of previously reported progress

Overview



Regular S355?

Model	E-Modulus [MPa]	Yield strength at 0.2% strain	Max strain [%]	Stress at max strain [MPa]
1 (regular S235)	210000	355	22	560
2	210000	355	11	480



SURVEY CONTAINER VESSEL CREW

Analysis of the results of the questionnaires and interviews

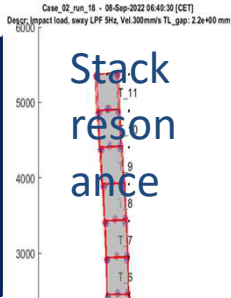
Report No. : 33039-S-PaS/MO
Date : June 2022
Version : 1.1
Draft report



TopTier

21 - Review Current Practice Container Cargo Securing

Report No. : 33039 - 2 - PaS
Date : June 2022
Version : 1.0



Workshop: Shore-Ship Operations

May 24, 2023, 10:00 – 16:00 h

"Meet Tuesday" Millenium Tower, Weena 690, Rotterdam, 23rd floor



Notice to Mariners

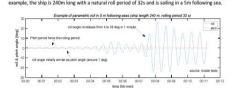
Beware of parametric rolling in following seas

A series of incidents with exceptional container losses occurred during the winter season 2020/2021. The TopTier project has been initiated to identify the root causes of these incidents, and to find out what other ship operators can do to prevent similar incidents. This notice describes the container-securement and operational risk factors, and aims to prevent parametric rolling in following seas.

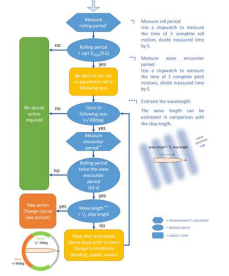
Notice to Mariners
Container cases are also vulnerable to parametric rolling in following seas conditions. Unfavorable combination of rolling period, vessel speed, heading, and wave conditions, can trigger sudden and extremely fast forward roll motions in following seas, threatening the safety of vessel crew and cargo. This can happen instantaneously with little warning.

What is parametric rolling?
Parametric rolling can occur when:
• The rolling period is close to twice encounter period
• Wave lengths are in the range of the vessel length

In these conditions, the passing waves cause a variation in waterline area that can trigger vessel instability or roll. This is most common in head seas, but can occur also in following seas, when the rolling period is long. Over a few high waves, after each other may trigger unexpected large roll motions, as shown in the measured free decay roll period responses in the figure below. In the example, the ship is rolling with a natural roll period of 20s, as a result of a 10m following sea.



When to be alert on parametric rolling in following seas?



Large motion simulator experiment Decision support complex seakeeping

ANY OTHER BUSINESS

Update on the progress of the Top Tier Joint Industry Project (JIP) on container losses
Submitted by Australia, Germany, Kingdom of the Netherlands, IUMI and WSC

SUMMARY

Executive summary: This document is to update the Sub-Committee on the progress of the Top Tier JIP on container losses.

Strategic direction: if Not applicable

Output: Not applicable

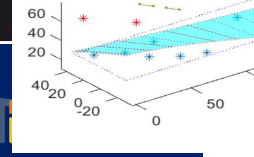
Action to be taken: Paragraph 12

Related documents: MSC 106/INF.16, MSC 104/17/4 and CCC 9/13

Review of incidents resulting

Report No. : 33039-1-SEA
Date : May 2022
Version : 1.2
Final Report

PARAMETRIC ROLL IN FOLLOWING SEA



Test #1

New Twistlocks
New Corner Castings



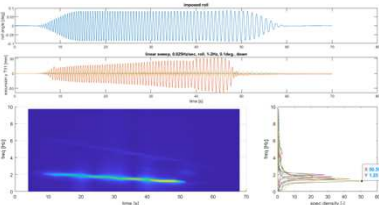
INTERNATIONAL STANDARD

ISO 668

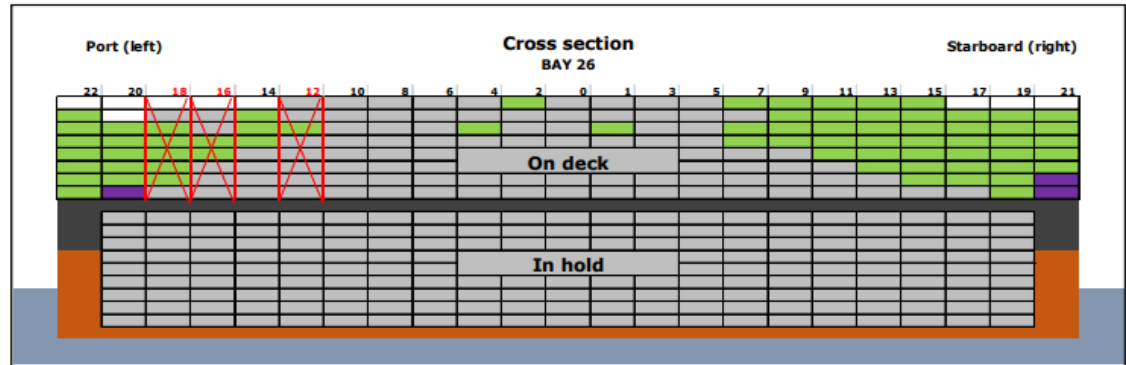
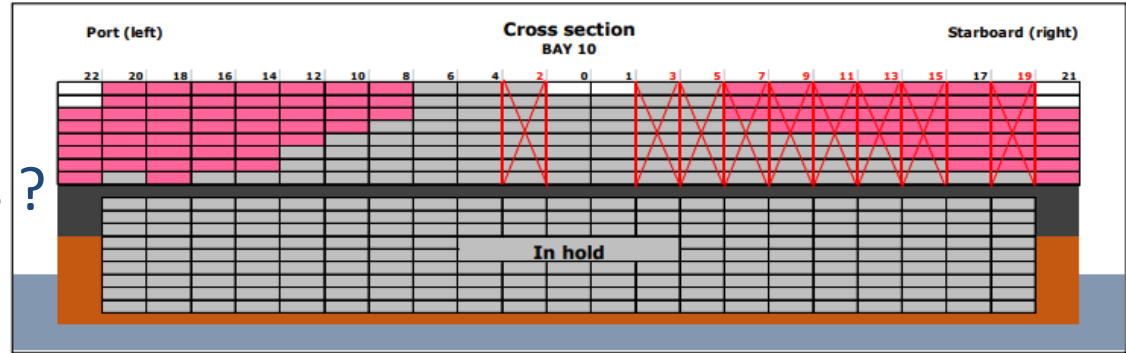
Seventh edition 2020-01

Series 1 freight containers — Classification, dimensions and ratings

Conteneurs de la série 1 — Classification, dimensions et masses brutes



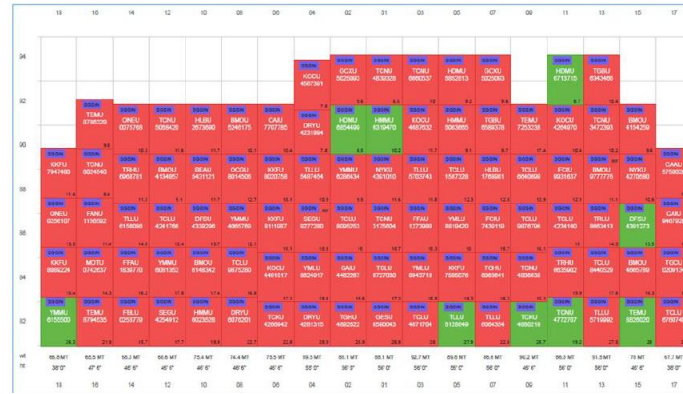

- Lashing SW ..
- Planning target ..
- What are real margins ?



Stowage positions

- Average over all surveys 10% !
- Approval stowplan unreliable
- Uncontrolled / potentially unsafe
- How does this happen
- How to improve

Third deck stow survey 25th September 2021



Bay 70
92% mis-stowed

Fifth deck stow survey 11th December 2021



Bays 53+54
15% mis-stowed

- Difficult to acquire data
 - 10 months data carrier owned owned containers
 - 1 week PSC inspection terminal (AUS)

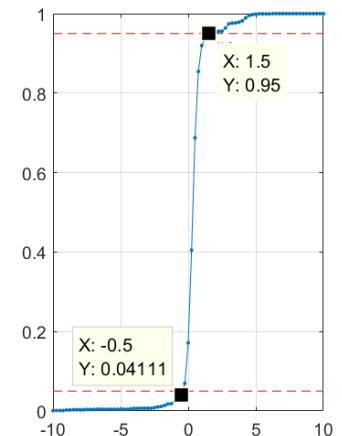
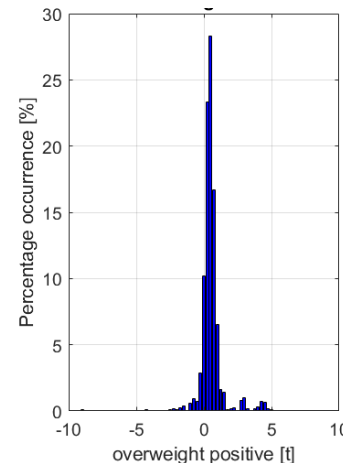
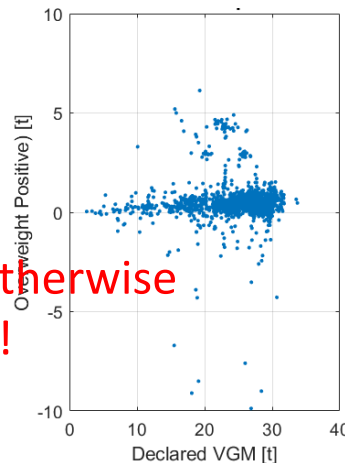
- Carrier owned :
 - 0.1% total nr “overweight”

- AUS:
 - Average overweight ~0.5 t
 - Standard deviation ~1.0 t
 - Highest variability in 20 t range.

- Variations in VGM seem small !
- Anecdotes & incidents suggest otherwise
- 0.1% much more than 0.0001 % !

Total number handled	3.35	million units
<u>Overweight</u>	2363	units
Underweight	579	units
Missing declaration	40720	units

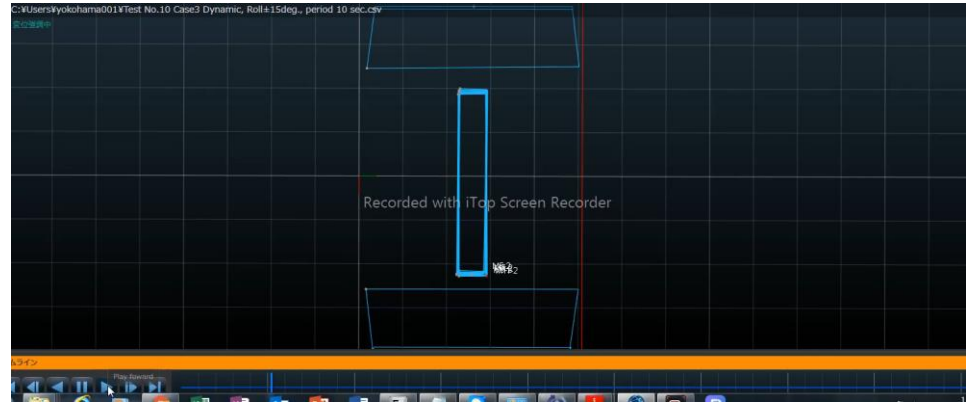
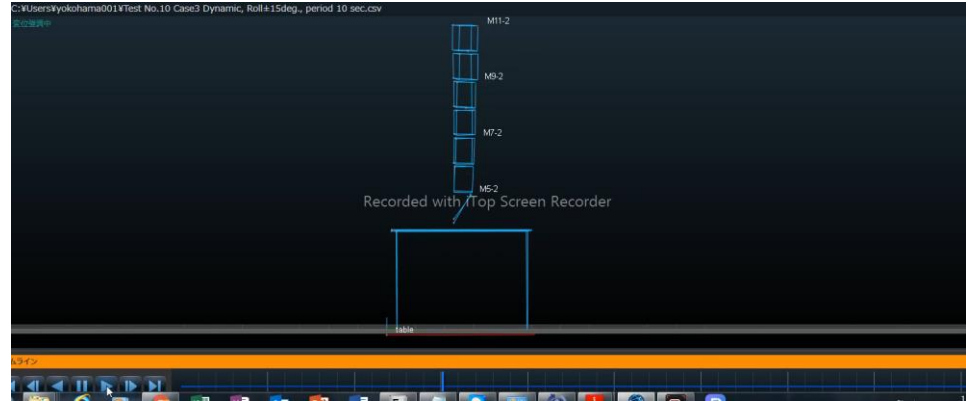
Only 0.09 % of the total volume is found to be overweight.
The boxes with missing declaration represent 1.2 % of the volume.



Container packing



Complex dynamics of stacks

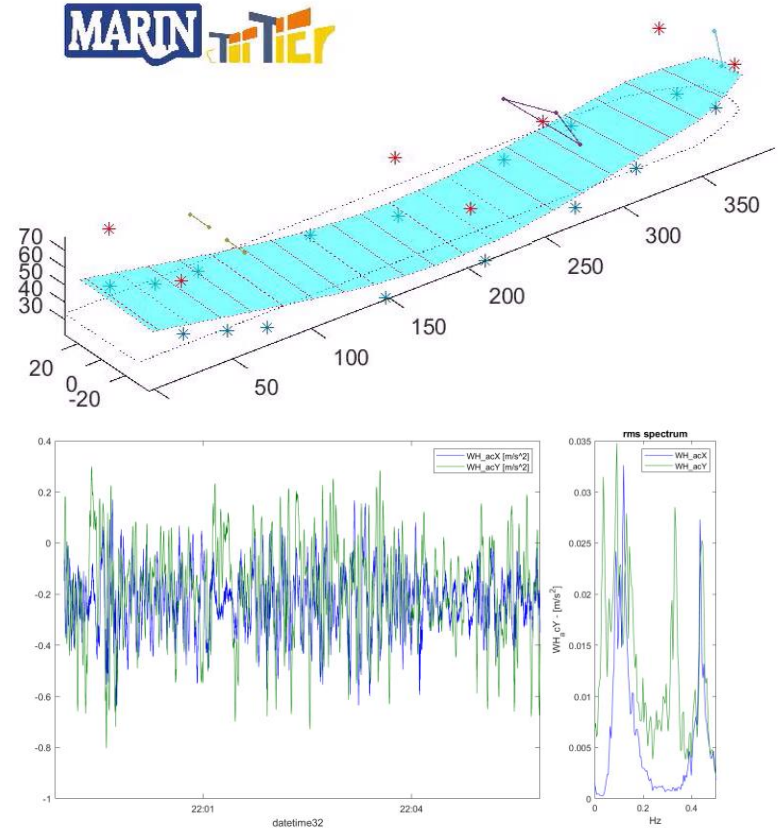


Dynamic effects missing in calculations
No harmonized approach

Dynamic interaction Cargo – Hull girder

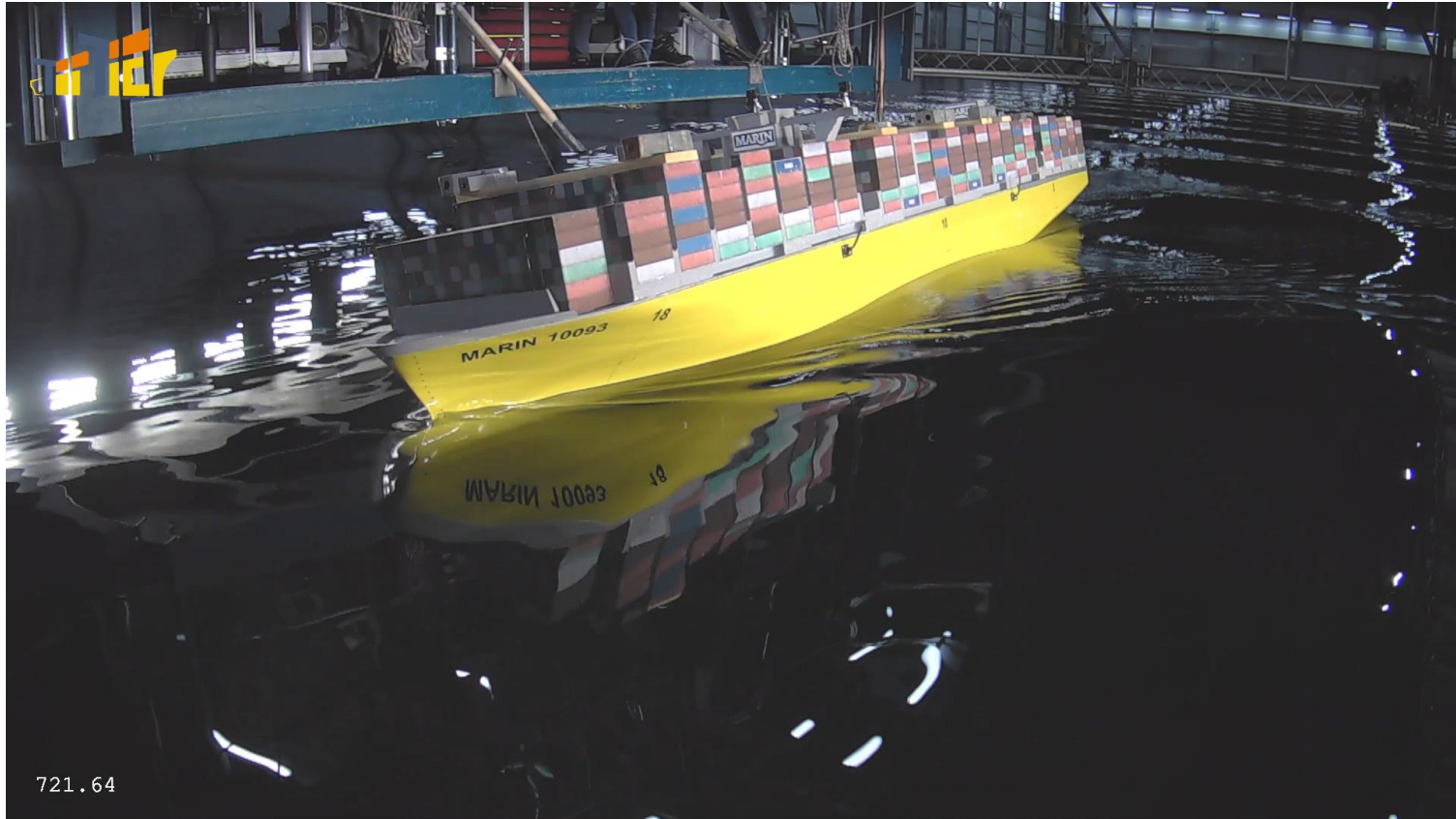


- On board measurements
- Clear hull girder dynamics
- No indicators / Limits / guidelines ..



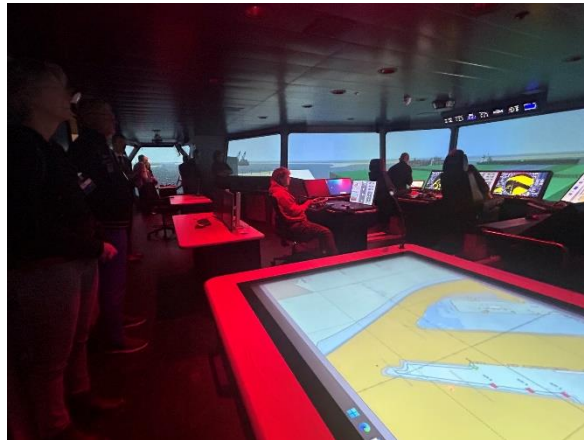
- How to inspect and maintain the huge numbers of parts ?





721.64

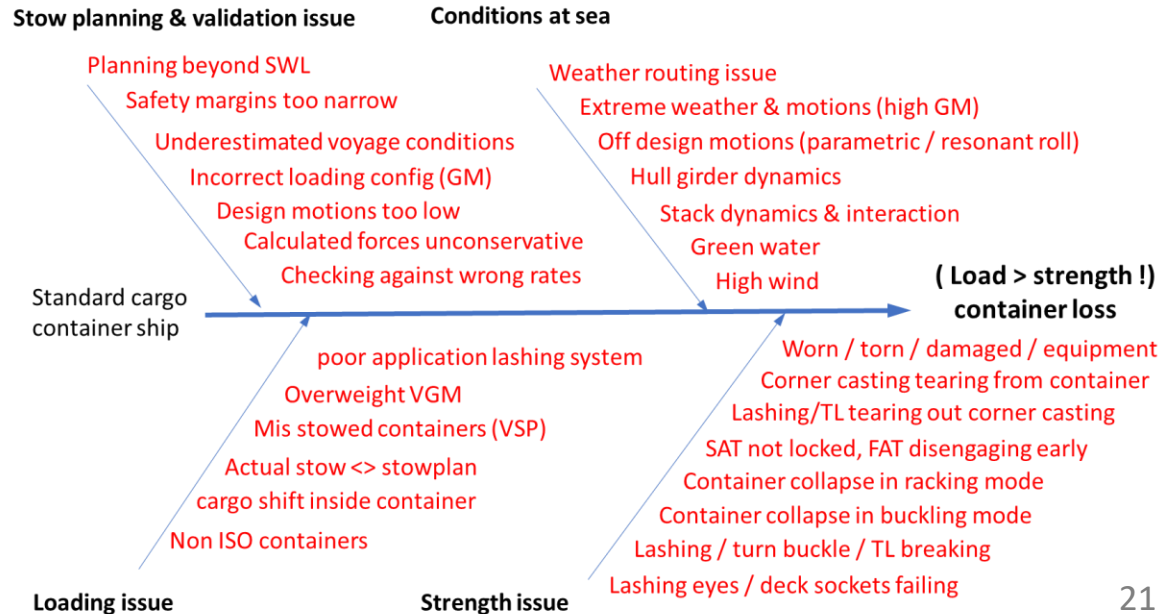
- Experiments on large motion simulator MARIN confirm
- Recognizing precursors of param roll is hardly possible without decision support or warning systems



Complete??



- Safety margins on strength side are tight
- Hazards to be handled or avoided -> Seem clear (for now)
- Technical options for improvement there for all except
 - Container stack dynamics -> least sensitive stowage ?? -> Operational guidance
 - Unified approach in service probabilistics loads and strength ?? -> standards & rules
- Regulatory frame work
 - IMO ongoing
- Industry adaptation ...



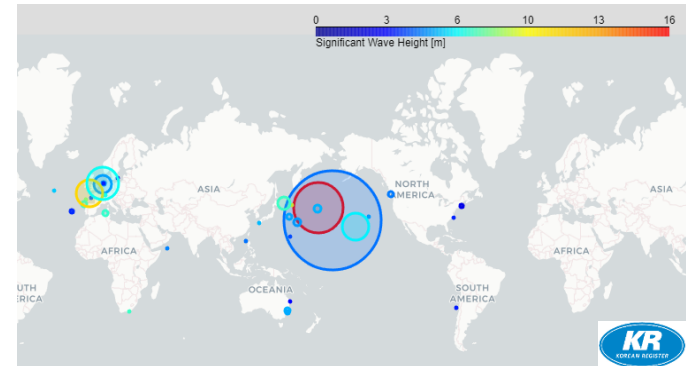
Key outcomes

50% of losses from few but Major Container incidents

- Causes for this type of incident: Exceeding design conditions: large rolling motions in waves, stack dynamics and resonance.

50% of losses from many, but Modest Container incidents

- Causes for this type of incident: a range of factors, such as failure of container material or lashing material, overweight cargo, or shifting of cargo in the container, in combination with heavy weather.



Incident location and scale (courtesy Korean Register)

Goal: Develop actionable guidelines aimed at reducing the risk of container loss at sea



Operational Process Issues

Stowage Planning
Underestimated Conditions
Low Safety Margins



Conditions at Sea

Extreme Weather and Motions
High Winds
Parametric Roll



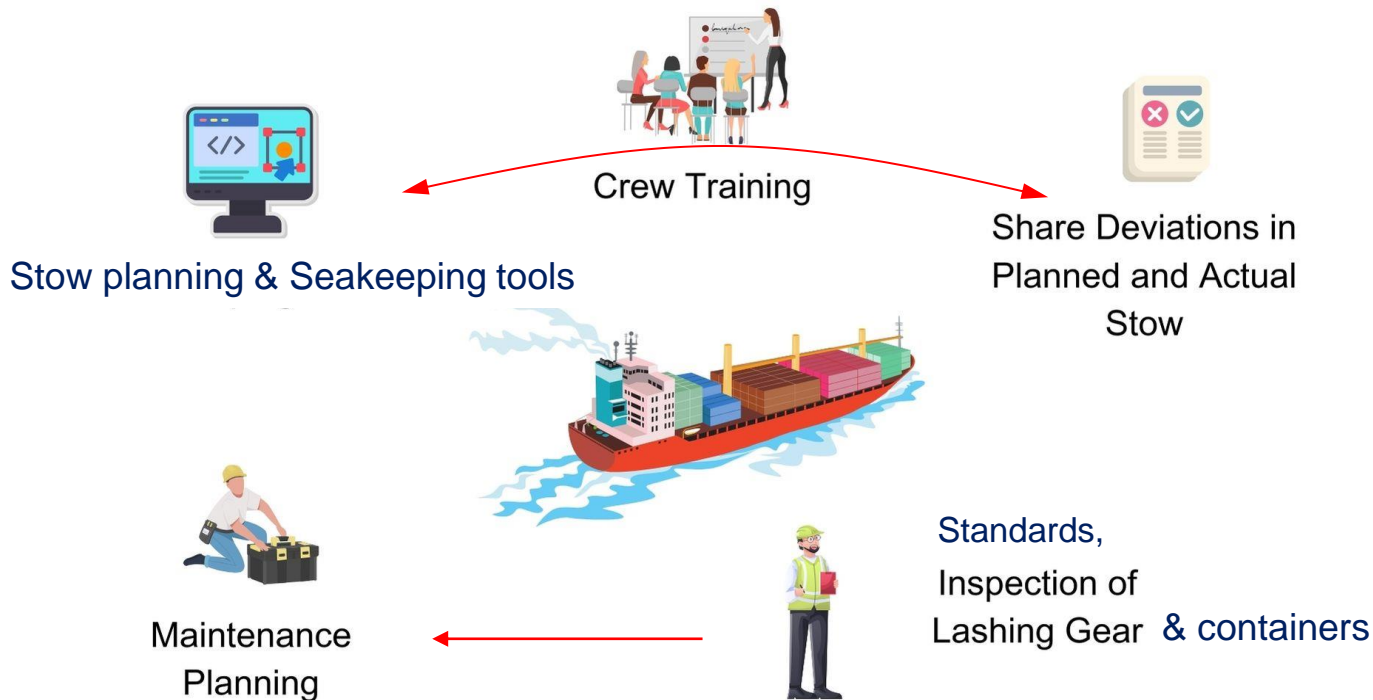
Loading Issues

Container Weight
Container Stow
Cargo Shift



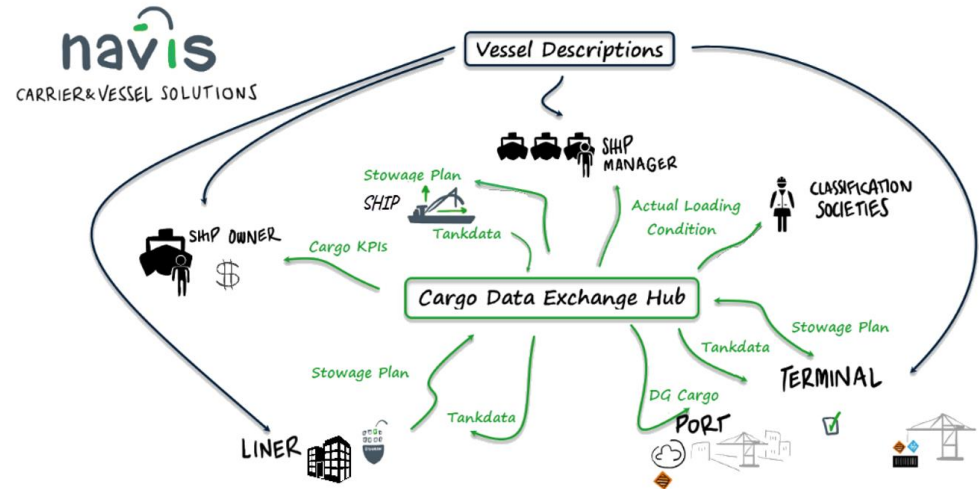
Equipment Issues

Damaged Lashing Equipment
Damaged Corner Castings
Container Stack Collapse



What is happening

- Rules & Regulations are under review (IACS / IMO / ISO)
- Carriers are reviewing inspection & maintenance solutions
- Decision support solutions are becoming adopted
- System vendors develop digital integrated solutions
- ...



- Regulatory frame work evolves in IMO -> roles & responsibilities
- How could industry innovate in the meantime

- Decision support
 - Prevent excessive motions -> next session
- Digitalisation & control
 - Agreement digital reality – real world
 - Enable focused inspection and maintenance containers & lashings
 - Second session – Digital (connected) cargo eco system

Questions for now ?



Contact:

Jos Koning

j.koning@MARIN.NL



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BETTER SHIPS, BLUE OCEANS



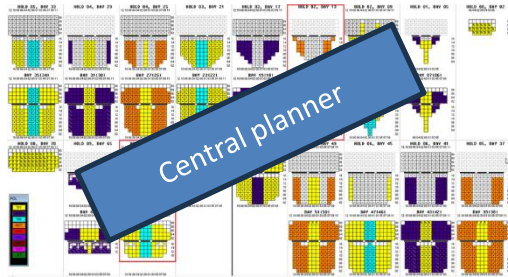
Container loss at sea – onboard perspective

Heike Diepeveen

The complexities of container shipping



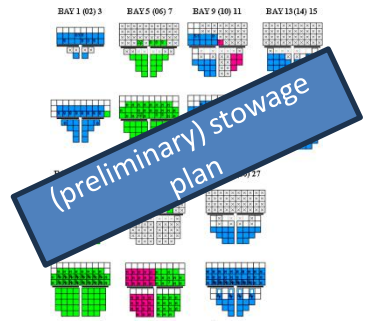
Pre-arrival



Central planner



Chief officer



(preliminary) stowage plan

In harbor



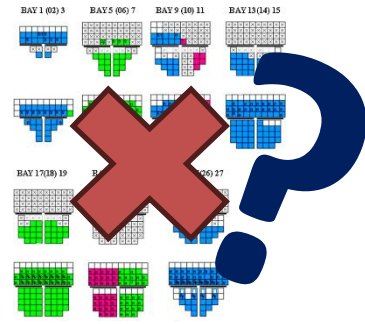
Chief officer



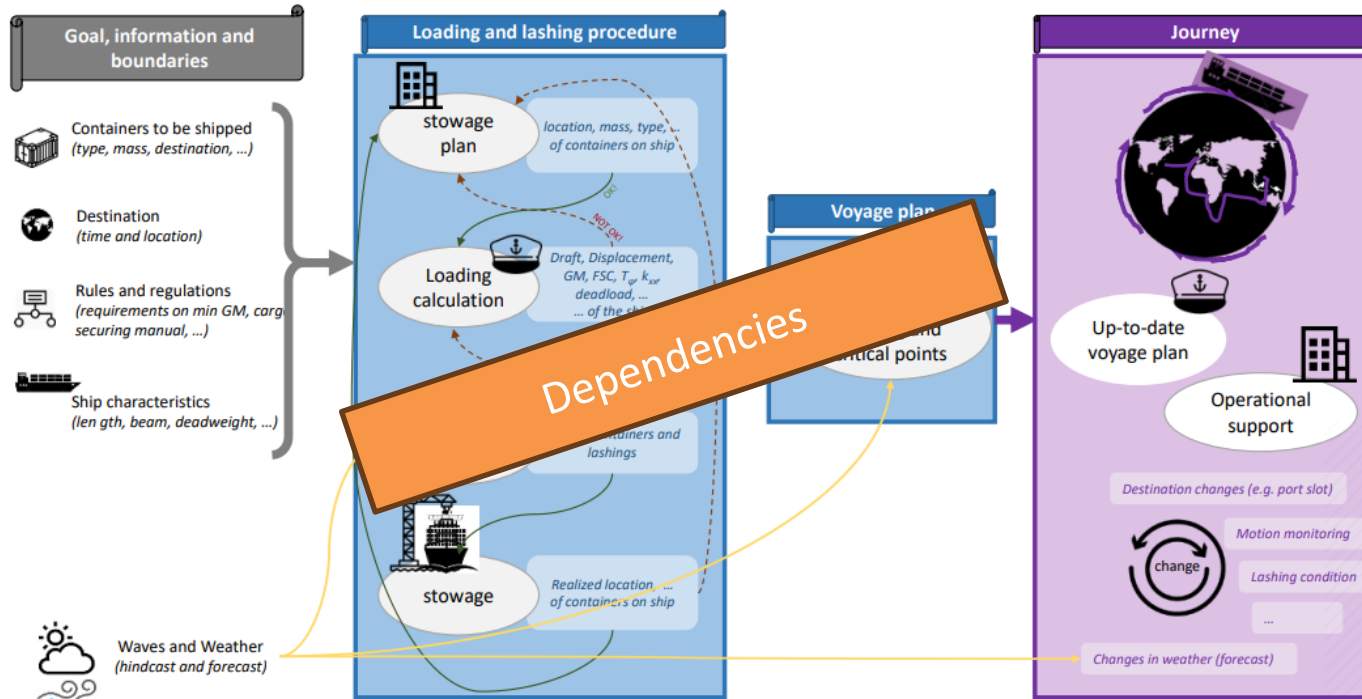
Stevedores



Crane operator



The complexities of container shipping



- Survey among 1542 seafarers
 - Prior to departure
 - During sailing
- 13 attention points
 - Prioritized together with TopTier consortium
 - Attention points divided over the different WPs

#	point of attention	TopTier priority	
1	It is difficult for ship's crew to keep an overview of the loading process of hundreds or thousands of containers. There is limited time, complicated communications, small influence on the process and limited control to implement a change.	mid	TopTier WG2
2	The condition of containers, especially corner castings, are considered a concern.	mid	TopTier WG1/WG2
3	Respondents indicate problems with automatic twistlocks. Multiple respondents have experienced this type of twistlock opening by itself during heavy ship motions.	mid	TopTier WG1
4	Masters find that terminal crew has a focus on fast rather than safe operation. Installation of lashing gear is not always done adequately by stevedores due to time pressure and lack of experience.	mid	TopTier WG2
5	The final loading plan is often only available in the last minutes before departure or after departure and the final loading plan often does not properly represent the cargo arrangement on and under deck.	top	TopTier WG2
6	Time pressure during the loading process is high. Roughly 25% of the respondents feel a commercial pressure to depart with potential risks in loading conditions and/or planned route	high	TopTier WG2/WG6
7	The roll natural period of the ship is an important factor in decision-making, yet the reliability and accuracy of the calculated roll natural period from the loading computer is limited.	high	TopTier WG5/WG3
8	Under way, crews operate in unpredictable circumstances with regard to weather and waves, with a lack of verifiable data about lashing conditions and loads, making decision making difficult	top	TopTier WG5/WG3/WG4
9	Predicting the response of the vessel to weather is hard, especially at night or in confused seas, and as a consequence crews may hesitate to take action.	mid	TopTier WG5/WG3
10	The vast majority of respondents claim to know how to prevent, recognise and act on parametric roll but very few ever experienced parametric roll. The actions described on what to do when it happens are diverse.	top	TopTier WG5
11	Navigation software tools are found to be helpful, however the availability and use of tools is not uniform.	mid	TopTier WG5
12	There is a large diversity in working methods, procedures etcetera, even within one company. Few best practices seem to be defined and there is limited opportunity to learn from each other.	top	TopTier WG5
13	Captains appreciate being informed by the crew when anomalies are found. It is, however, not that common, which is a cause of concern for captains.	low	Individual Companies

Crew survey – prior to departure



“ The final plan comes at the last minute and the terminal planners and lashing personal DO NOT have any idea of the responsibility they have in giving their best support for a departing Ship.”

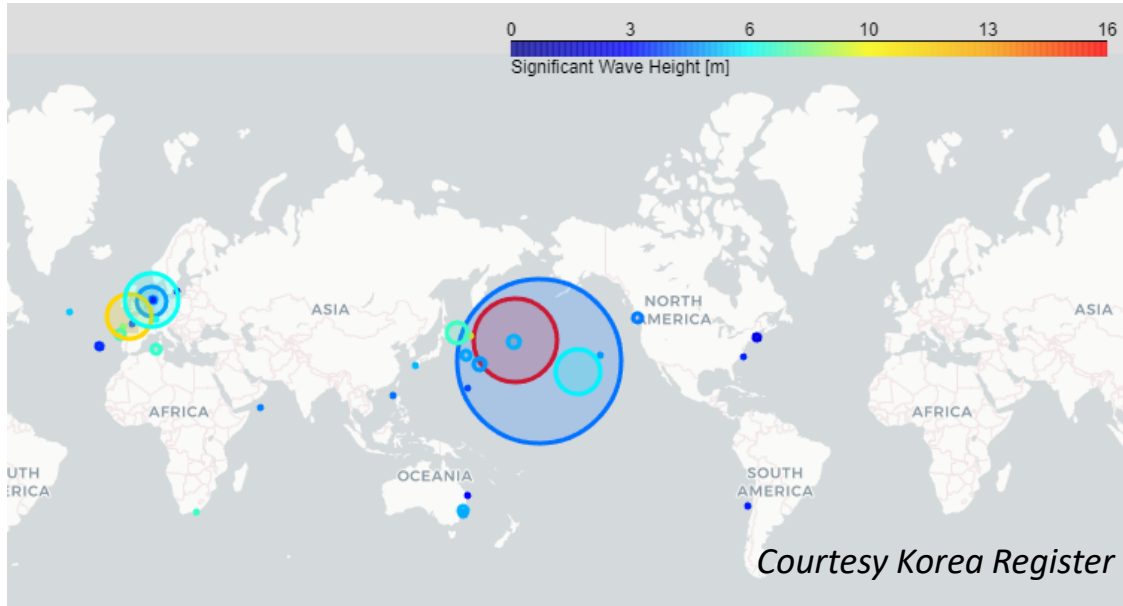
“ The lashing pattern as per CSM is mostly not followed by stevedores. The designated turnbuckles are not put in their designated place in spite of ship staff reminding them continuously.”

“Many times there is no sufficient time between end of operations and sailing time to properly check lashing and cargo. Commercial pressure is sometimes very high.”

“Vessel Master had neglected weather forecast in order to follow vessel schedule. The vessel goes through developed Low pressure with a maximum speed, late in the night start experienced heavy pounding and signs of parametric rolling had occurred. There was two pitch cycles for each roll cycle and maximum roll always occurs when the ship pitches down. Quite unexpectedly, the roll angle increased from a few degrees to over 30 degrees in a few cycles”.

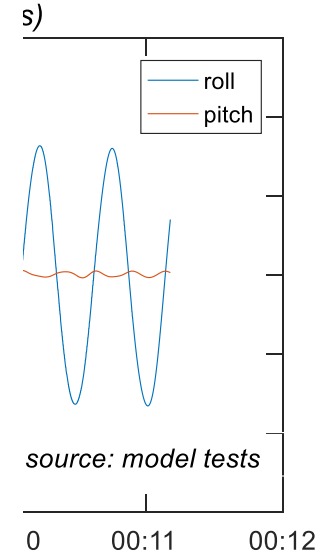
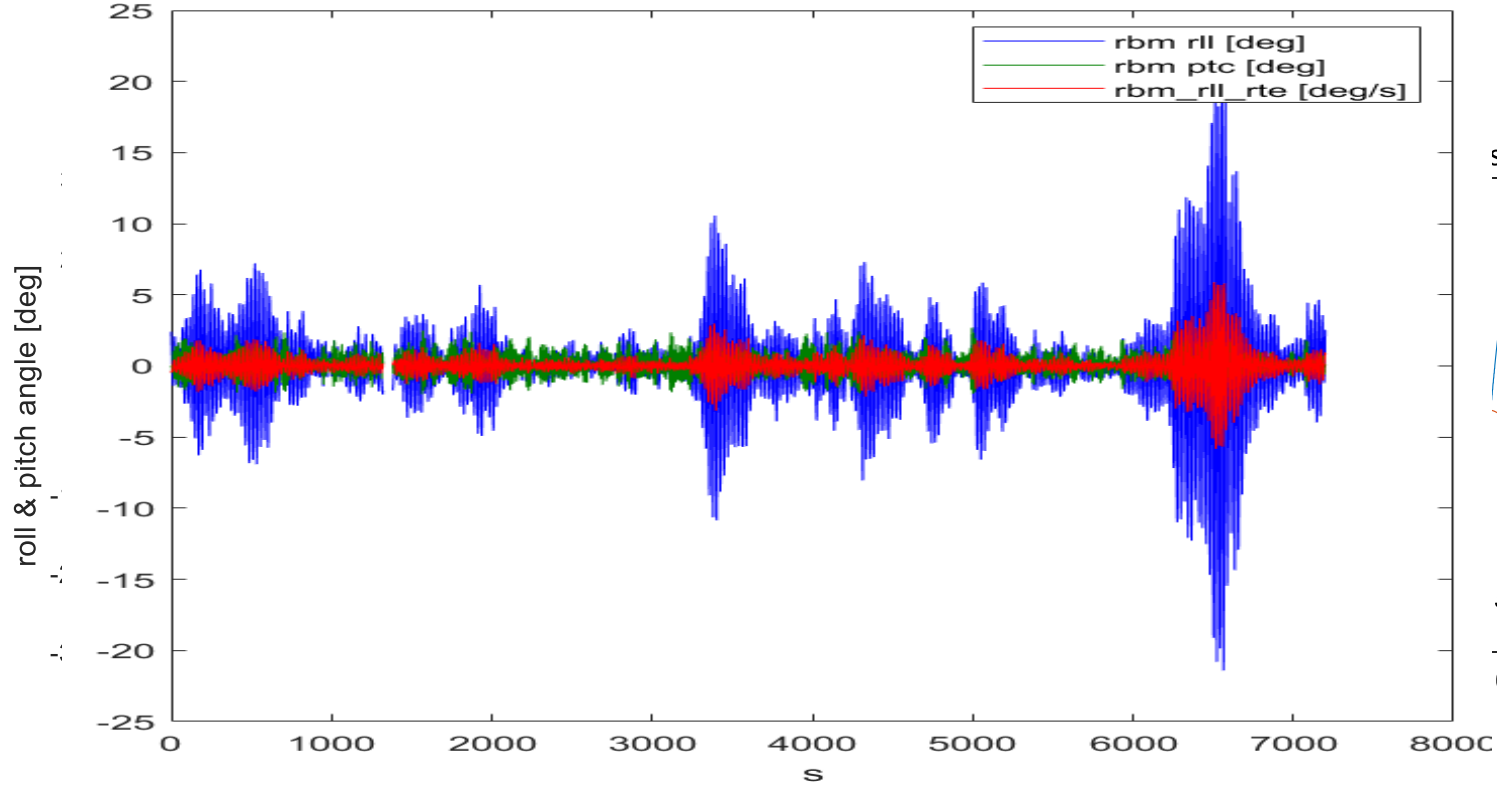
“Will be good to have sensor with Roll period calculated automatically”

“I sometimes consider it too technical or would say too little information is being given to the ship with regards to the roll period and lashing loads. Some sort of guidance is to be given or softwares to be delivered to allow ships to monitor their progress across oceans in real time conditions and how the roll period could actually impact the lashing onboard.”



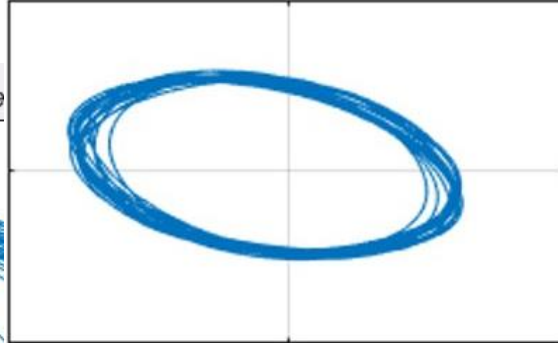
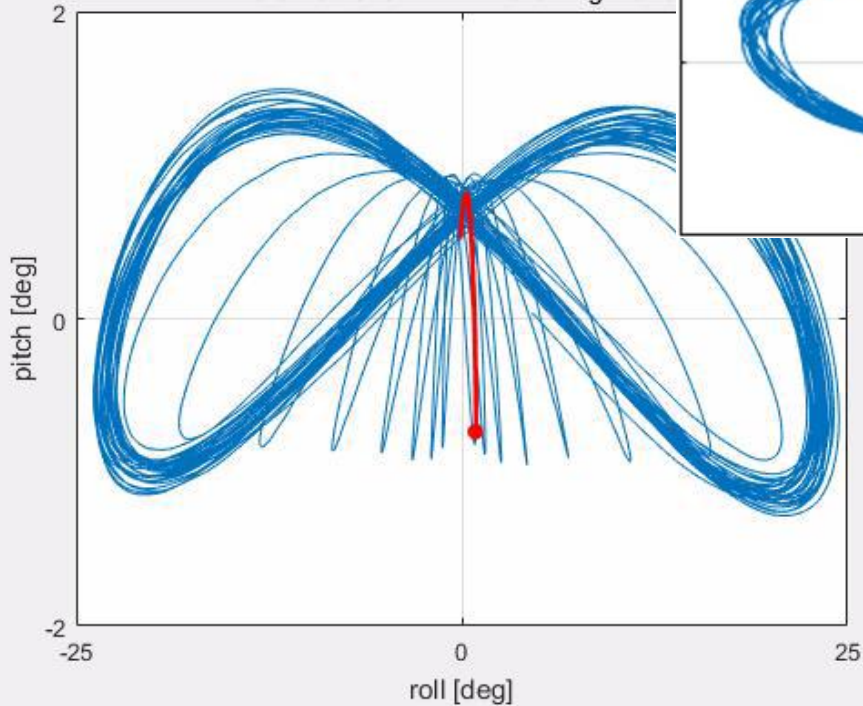
- 44 Incidents evaluated
- Involving 9824 lost/damaged containers (5% in 6 incidents)
- Related to large roll motions

Parametric Roll – When does this happen?

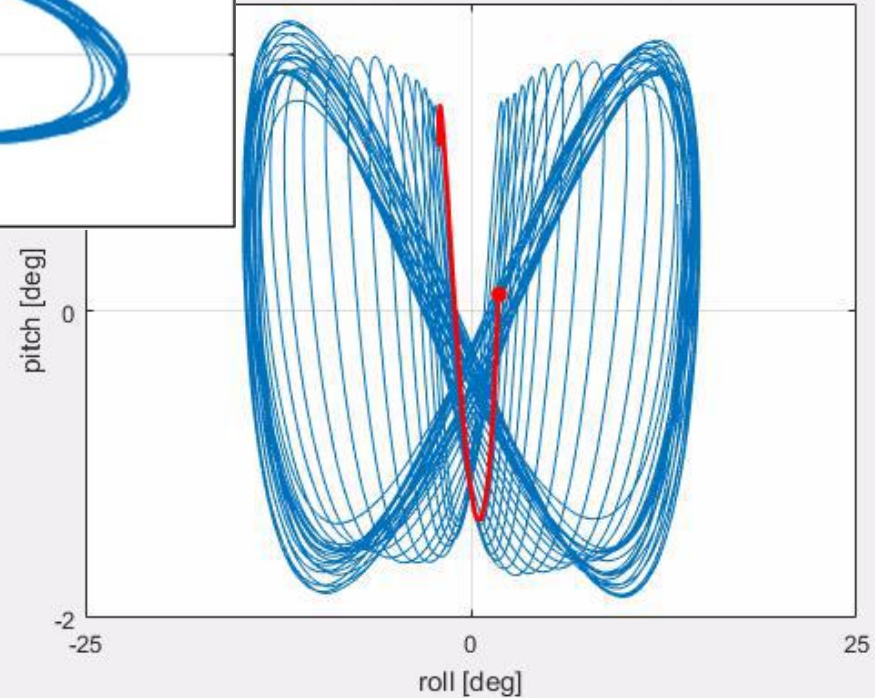


It's all about phasing..

Parametric roll in 4 m following wave



Parametric roll in 4 m head waves



Beware of parametric roll

Watch and learn how you can recognise and prevent parametric rolling



Watch the video to learn about parametric roll in following seas.



Read the Notice to Mariners and a flowchart for details.



Use the calculation tool for explicit guidance.

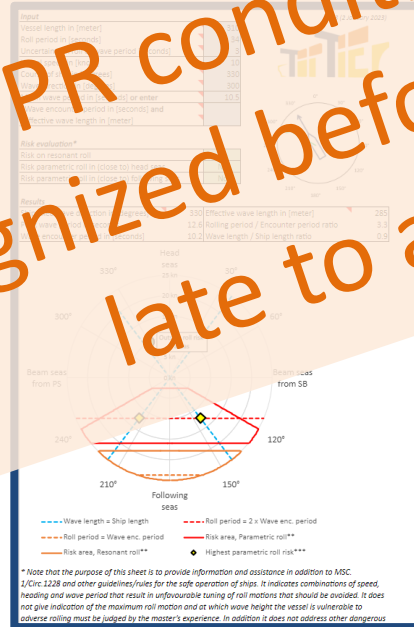


ROB GRIN
Senior Principal Engineer

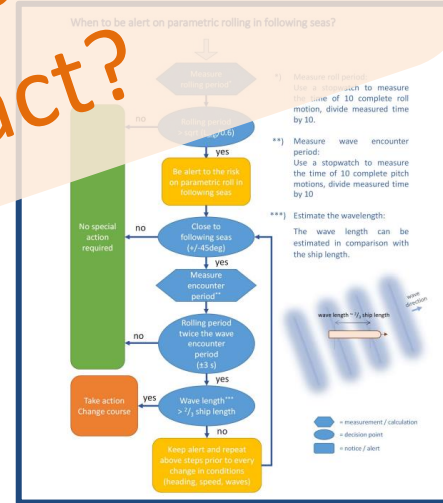


JOS KOOIJMAN
Senior Principal Engineer

Can PR conditions be recognized before it is too late to act?



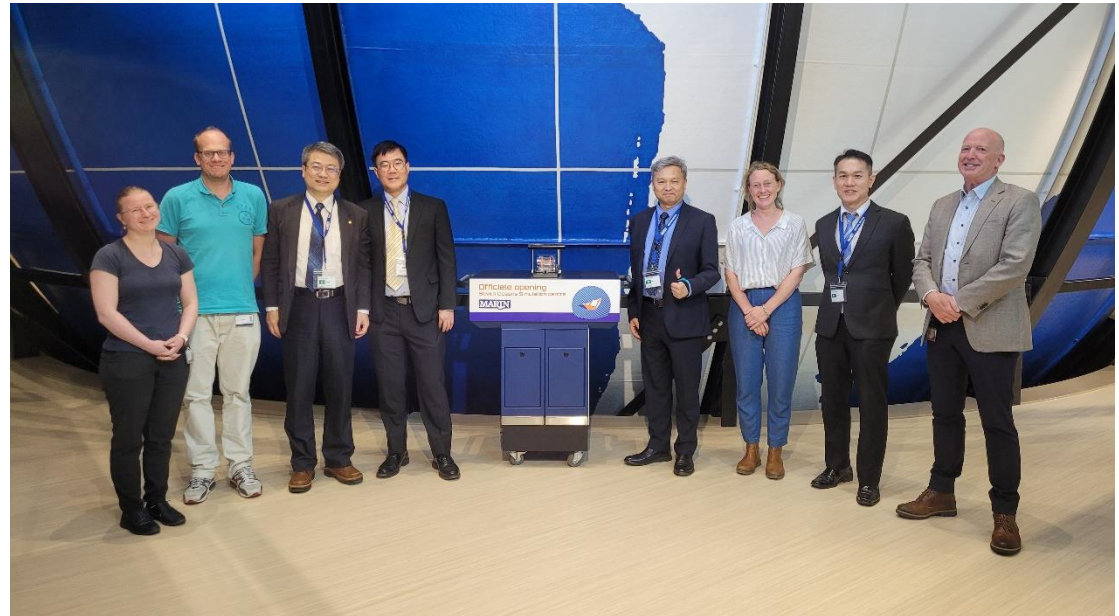
*Note that the purpose of this sheet is to provide information and assistance in addition to MSC 1/Circ.1228 and other guidelines/rules for the safe operation of ships. It indicates combinations of speed, heading and wave period that result in unfavourable tuning of roll motions that should be avoided. It does not give indication of the maximum roll motion and at which wave height the vessel is vulnerable to adverse rolling must be judged by the master's experience. In addition it does not address other dangerous

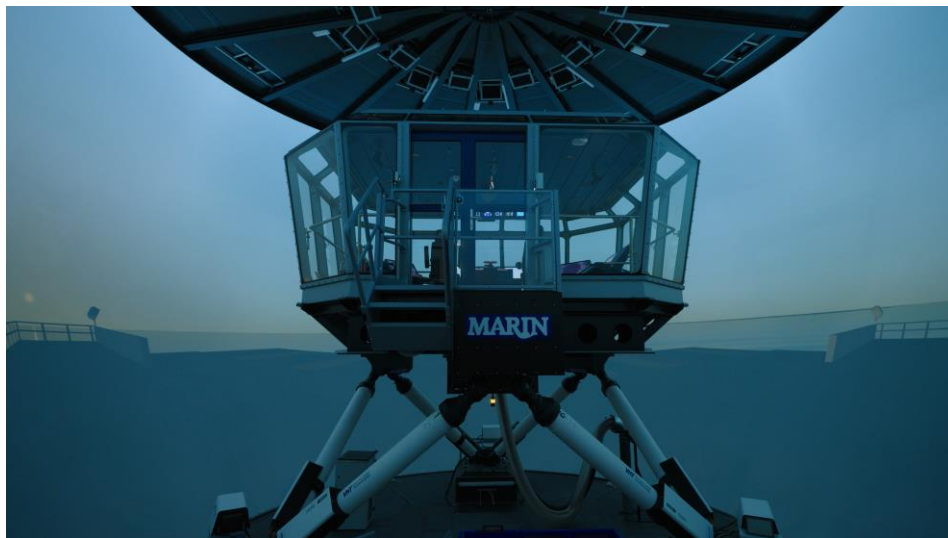


Moving base experiment



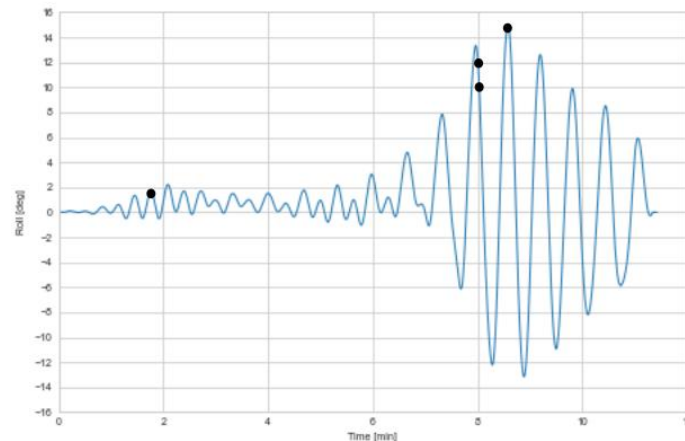
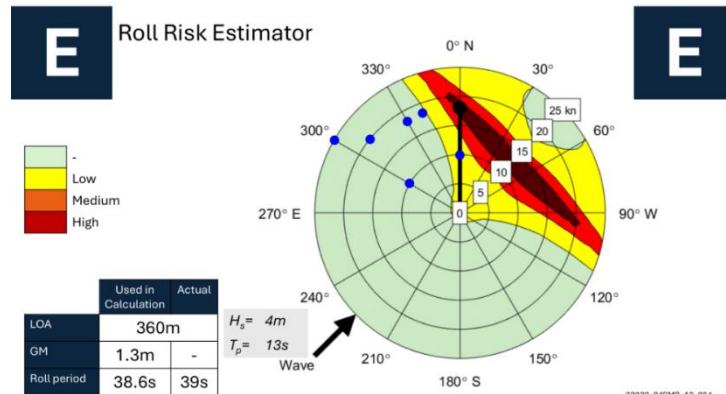
- 15 captain, first/second officer
- Watchkeeping
- With/without roll risk estimator





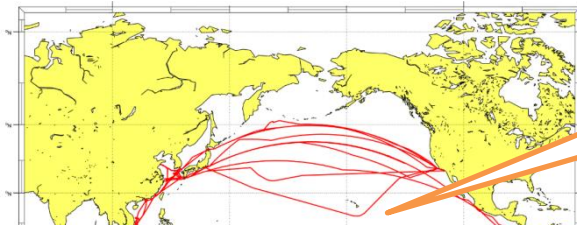
“Operational guidance should be in place if parametric roll is assumed to be avoided by the seafarer.”

Pro-active & Re-active

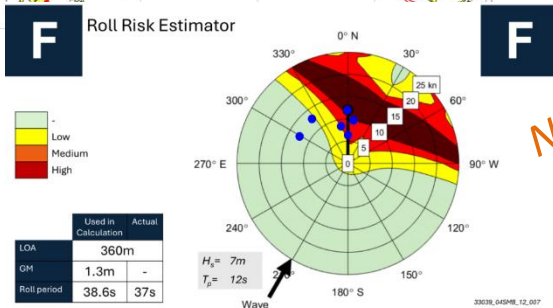


Prevent parametric roll

Weather routing

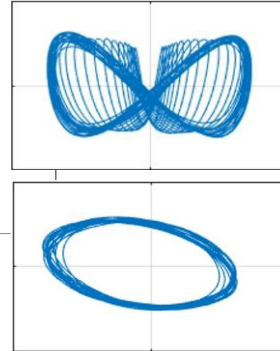
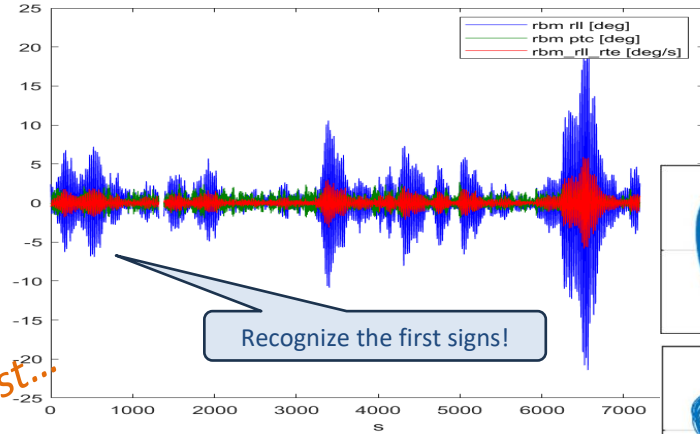


Parameter accuracy!



Roll risk estimator
(e.g. polar diagram)

Not watertight...
GM, Roll,
weather forecast...



- Alert on first signs
- Information to *diagnose* (e.g. butterfly)
- Know what to do (e.g. polar diagram)
+ *awareness & procedures* (e.g. training)

Pro-active

&

Re-active

Decision making pattern 1:

- **Observe:** the participant looks at all information available to him/her to reach level 1 situational awareness.
- **Orient:** the participant tries to get an understanding of the available information. The participant sees the roll risk in the polar plot and addresses to be more vigilant. The participant proceeds to observe the ship behaviour through the outside view, inclinometer, and their own feeling.
- **Decide:** the participant observes that the roll angle of the ship is increasing. The participant looks at the polar plot to see what course and/or speed changes would bring the ship into safer conditions.
- **Act:** the participant changes course and/or speed.

Decision making pattern 2:

- **Observe:** the participant looks at all information available to him/her to reach level 1 situational awareness.
- **Orient:** the participant tries to get an understanding of the available information. The participant sees the roll risk in the polar plot and addresses the desire to avoid these conditions.
- **Decide:** The participant decides to take action right after seeing the polar plot to avoid unsafe roll angles.
- **Act:** the participant changes course and/or speed.



Avoiding major off-design container losses

BLUE WEEK MARIN WAGENINGEN

Realtime Parametric Roll warning system

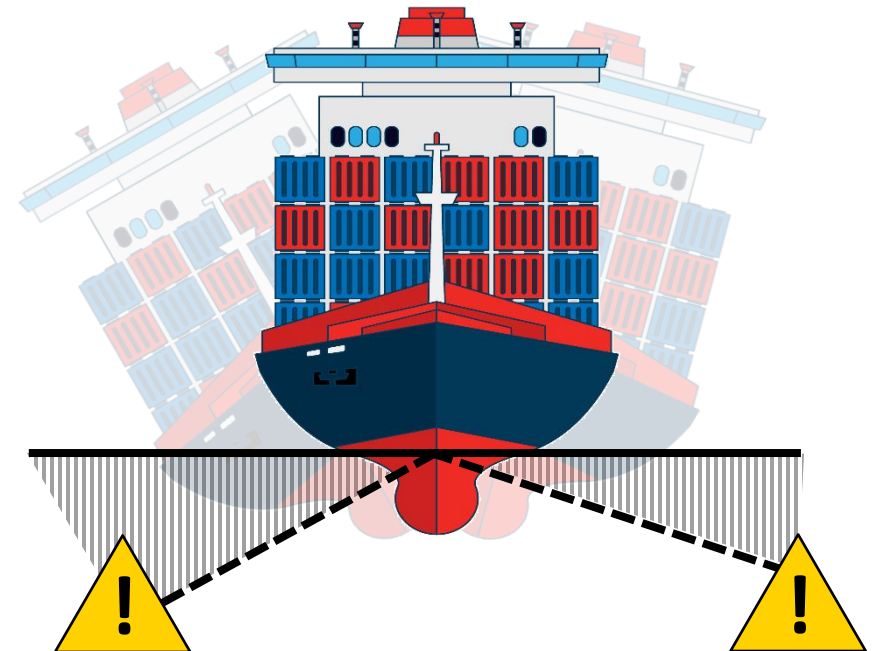


ENGINEERED
TO OUTRUN

Parametric roll prevention

What is parametric rolling?

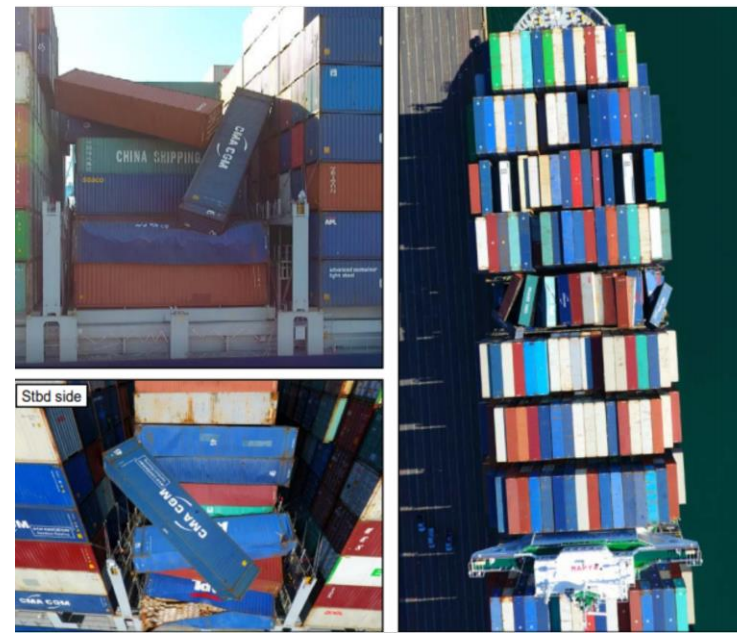
- Vessel's roll motions increase due to varying stability in combination with wave encounter period matching half the natural roll period
- The stability varies due to the wave crest passing alongside the vessel, in following and head seas
- The wave shape follows the vessel geometry and additional pitch motions may increase the wet surface further, causing a periodic increase and decrease of stability
- If the wave period is half of the natural roll period, the roll motion can amplify during each roll cycle
- The amplitude can get excessive quickly to 20+ degrees within 10 cycles.



- Since 2009, CMA CGM fitted its owned vessels with capacity over 3000 Teus with Octopus on board. With currently 200+ vessels installed.
- A DMAIB investigation on parametric roll event and the Marine report state :

*“Detecting risk of parametric resonance rolling based on forecasted sea conditions can be problematic as forecasts are encumbered by uncertainty. No matter how automatized and detailed the onboard tools for monitoring parametric resonance are, they are prone to the uncertainty of the forecasts which make them unreliable as tools, unless a broad risk margin is applied. **DMAIB encourages companies and authorities to explore and test options for predicting resonance effects that are based on real-time conditions rather than forecasts,**”*

- 2020/2023 CMA CGM FLEET CENTER INITIATE a Doctoral Thésis Probability of occurrence of parametric roll on a predefined sea state.
- In 2024 in cooperation with ABB, introduction of the first tool to predict parametric roll in real time, based on the ratio of the roll period over the pitch period.

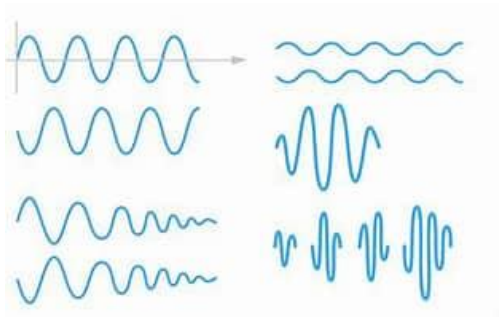
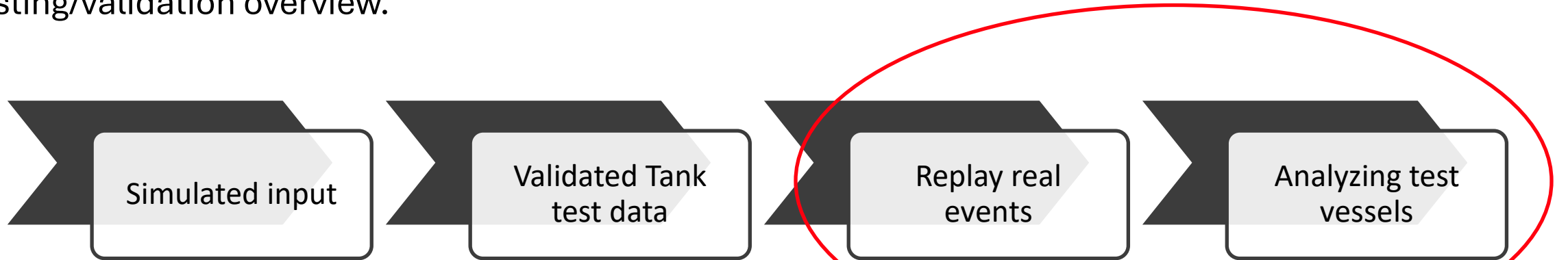


2018
CMA CGM G.
Washington lost 137
containers in North
Pacific

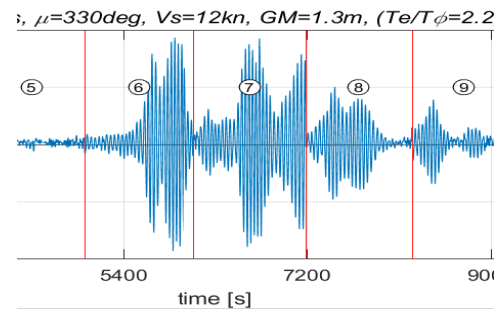


Testing/validation overview

Testing/validation overview.



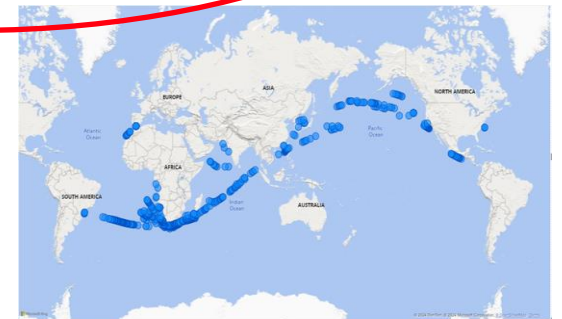
Generated roll and pitch



Roll and pitch measurements from the TopTier model tests



Rerun with measured motion data from vessels with parametric roll



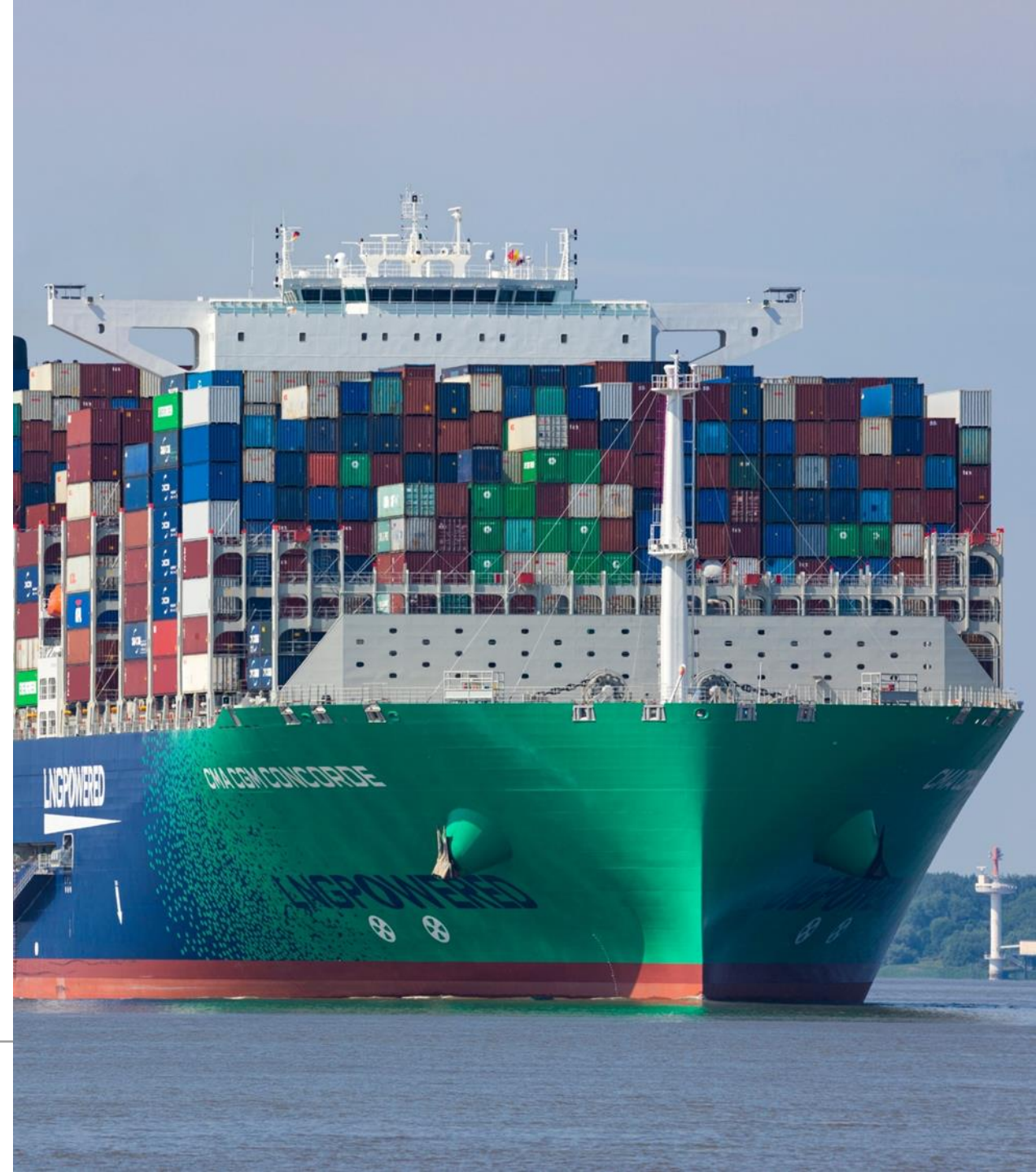
Data research on vessels installed with Parametric roll alarm

Parametric Detection System

Parametric roll

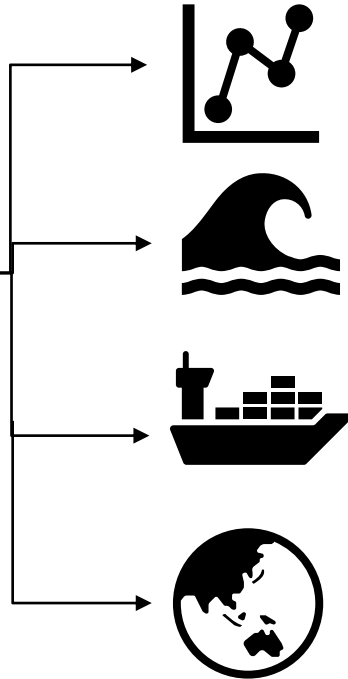
Computer with detection algorithm

- Motion sensor on bridge for Realtime measurement
- Additional Connection to:
 1. navigation (GPS, Gyro)
 2. Loading computer for draft and stability
 3. Weather routings system for wave conditions



Data collection

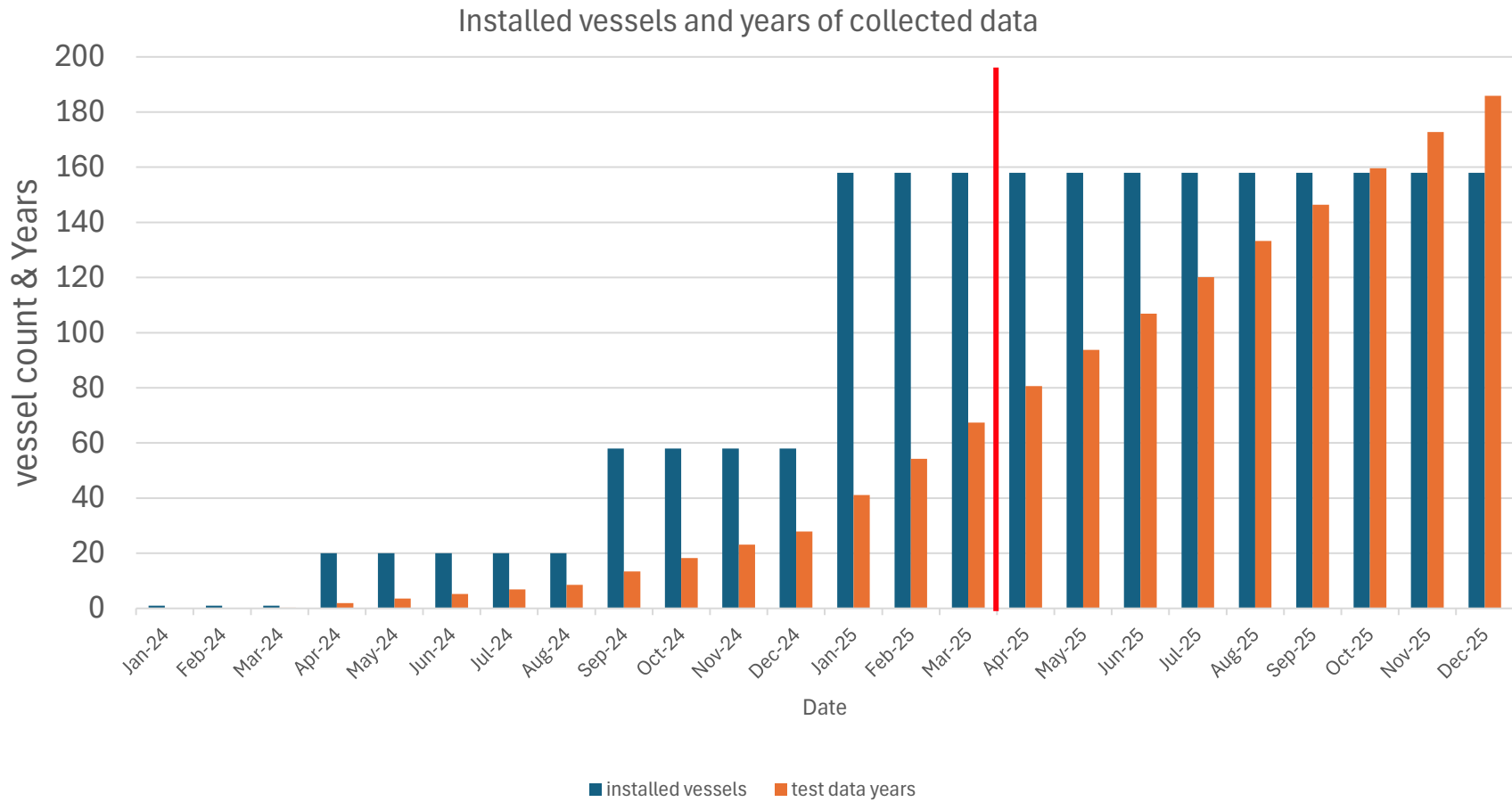
General setup



- Motions 6 DoF
- Parametric roll alarms
- Weather conditions (Bon Voyage or SPOS)
- Loading parameters (draft, GM)
- Navigational data

Data collection with active parametric roll detection

Installed vessels with Parametric roll detection and research data

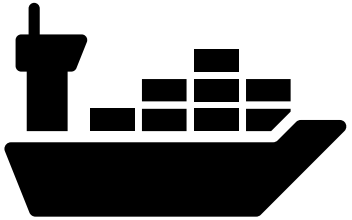


- Current research database contains 60 years of operational data.
- Next year estimate: 180 years of data available.



Replay real events

Investigation of early warnings on vessel behavior.



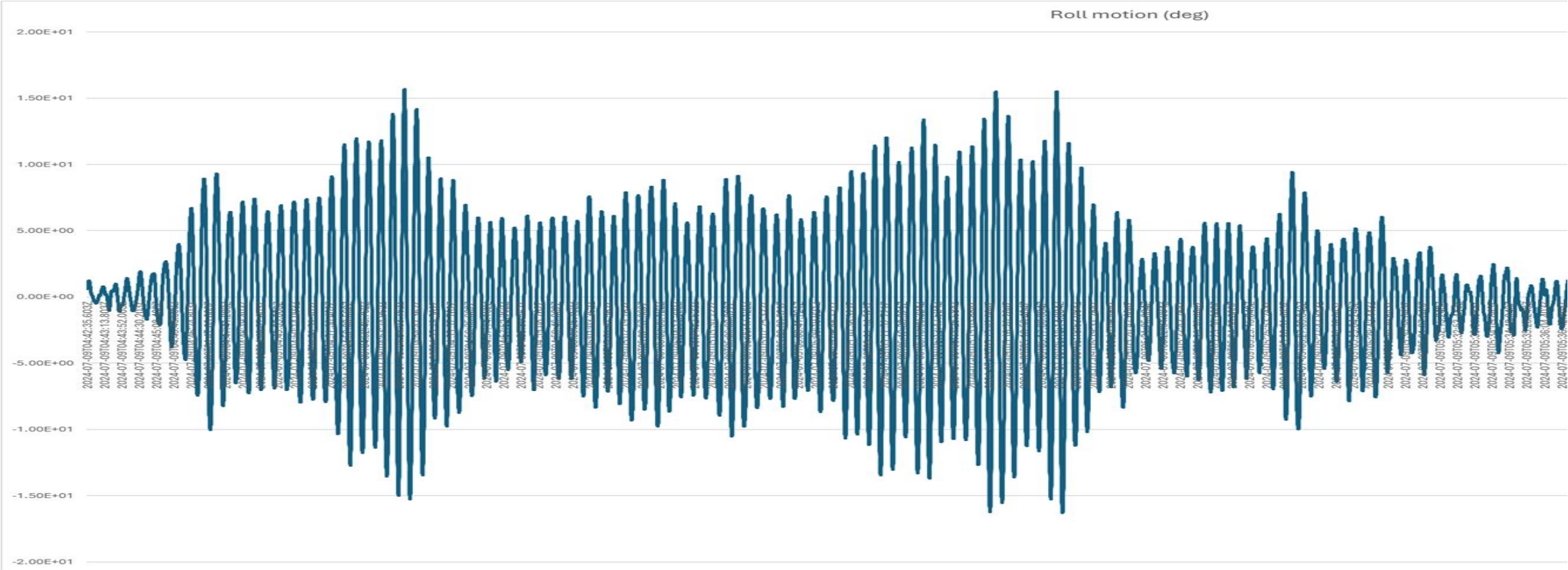
Realtime vessel data where motions have been recorded during an events.

- Is the event detected?
- Are there warnings upfront?
- Algorithm tuning

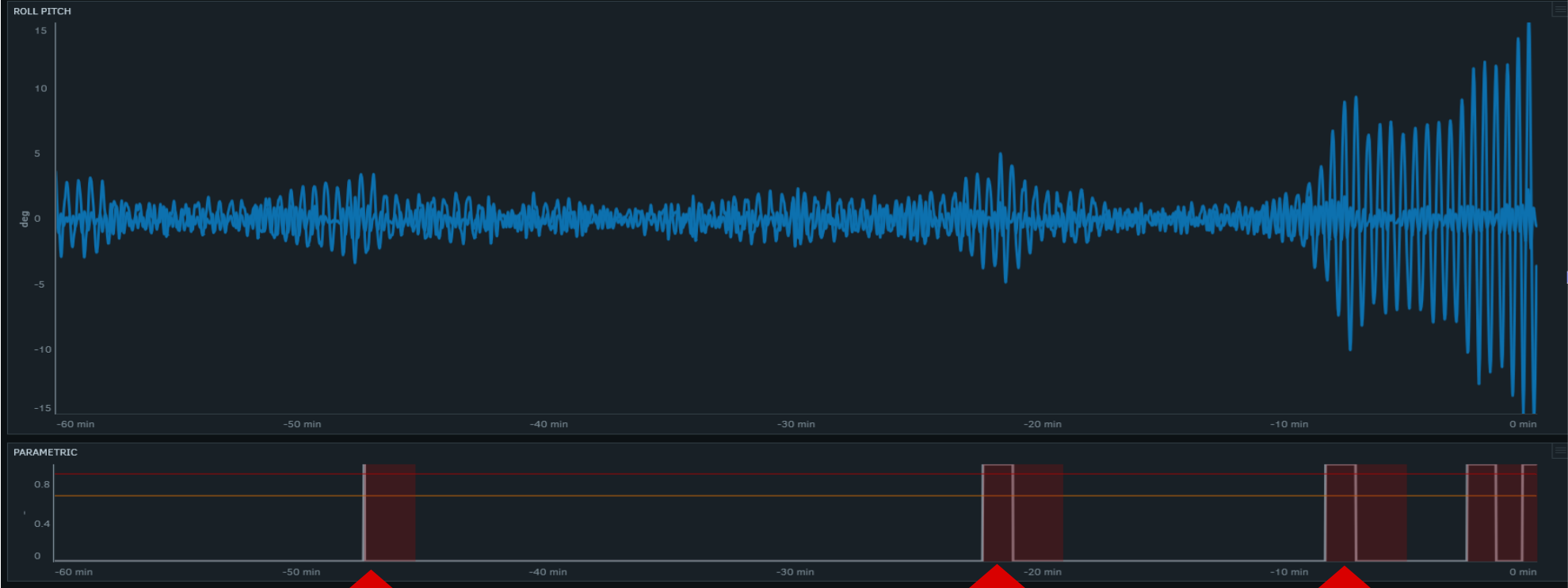
All events where parametric roll was detected also delivered warnings in the hours before the event.



Vessel in parametric roll



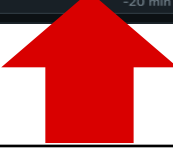
Alarms identified before high roll



Vessel roll



Detection 45 minutes before



Detection 20 minutes before



Detection 9 minutes before



1 Hour timespan

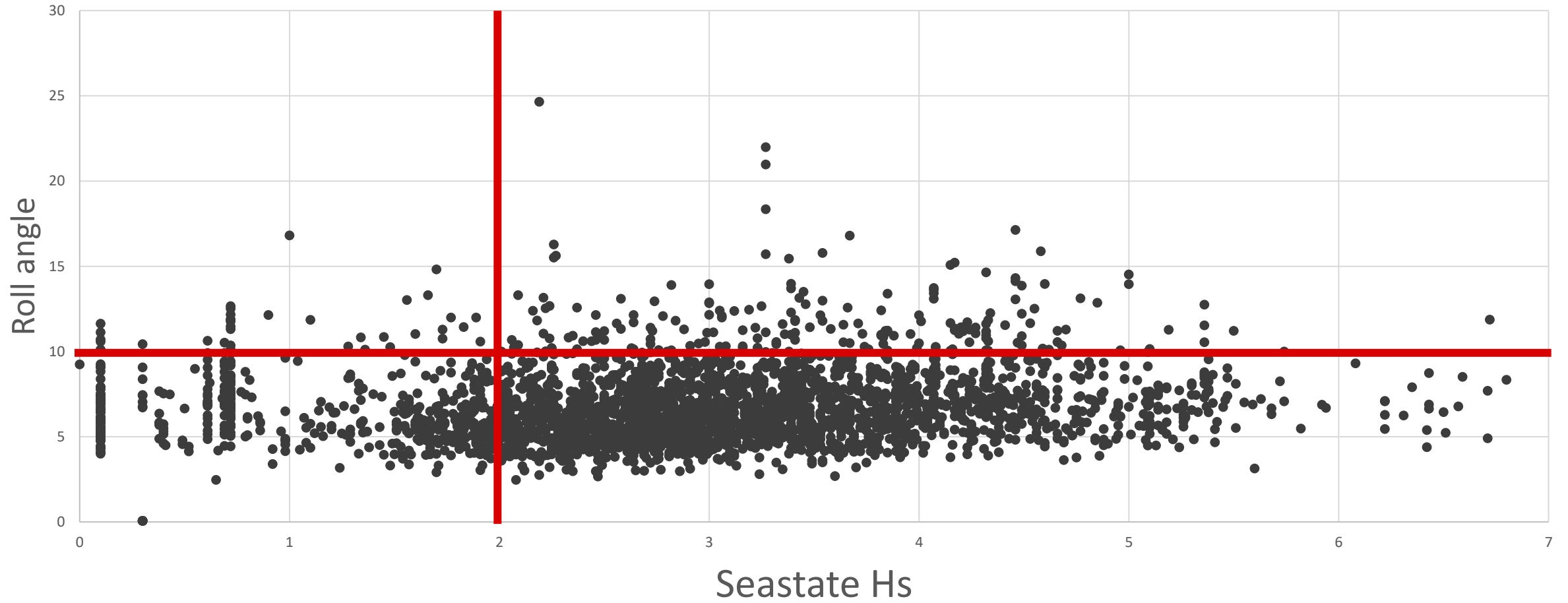
Realtime Parametric Roll warning

avoidance zone when parametric roll is detected



Detection history





Learning from monitored data

Fleet risk assessment, vessel class dependent risk overview, voyage risk indication



Locations of parametric roll alarm, 60 operational years

14 minutes parametric roll/vessel/year

	under 10 degrees of roll	above 10 degrees of roll
under Hs 2 meter	15.7%	1.8%
above Hs 2 meter	74.1%	8.4%

- 1 minute per vessel per year in high parametric roll (Hs +2 meter)
 - 10 minutes per year in high risk parametric roll

Note: Trial vessels have been selected on increased risk by passage and season.





Chance of High parametric roll in time: 1:500.000
In this picture represented by the weight of the paint
of the waterline.

Avoiding major off-design container losses

Off design container loss is a risk:

- A captain has a small chance to encounter extreme Parametric during his career:
1 out of 66 Captains
- A container ship during its operational life:
1 out of 40 vessels
- A container liner with 40 vessels:
once per 25 years
- A major container liner:
Every 1.5 years



Why is there an airbag in my car?? I have never used it.....



Why has my car an airbag? I have never used it.....

A B B

TopTier JIP Open Meeting, 8 April 2025



Containers lost at sea: The role of marine property insurers

Hendrike Kühl
Policy Director
International Union of Marine Insurance

Agenda

- 1 Some figures
- 2 TopTier and IUMI
- 3 Going forward



Marine insurers
must have data!



IUMI

Claims types by volume and costs



Type of claims by volume

P&I cargo, container, 2015-2019

Cost =>USD 5,000 – uncapped

As per 14/8/2020



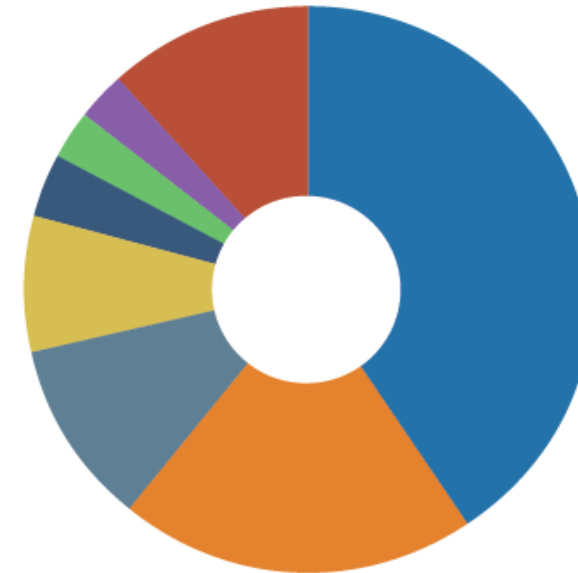
Wet damage	27.9%
Temperature damage	21.9%
Physical damage	18.1%
Unclaimed cargo	5.6%
Off-spec	4.7%
Lost overboard	4.2%
Deterioration	3.3%
Uncategorised	14.3%

Type of claims by cost

P&I cargo, container, 2015-2019

Cost =>USD 5,000 – uncapped

As per 14/8/2020

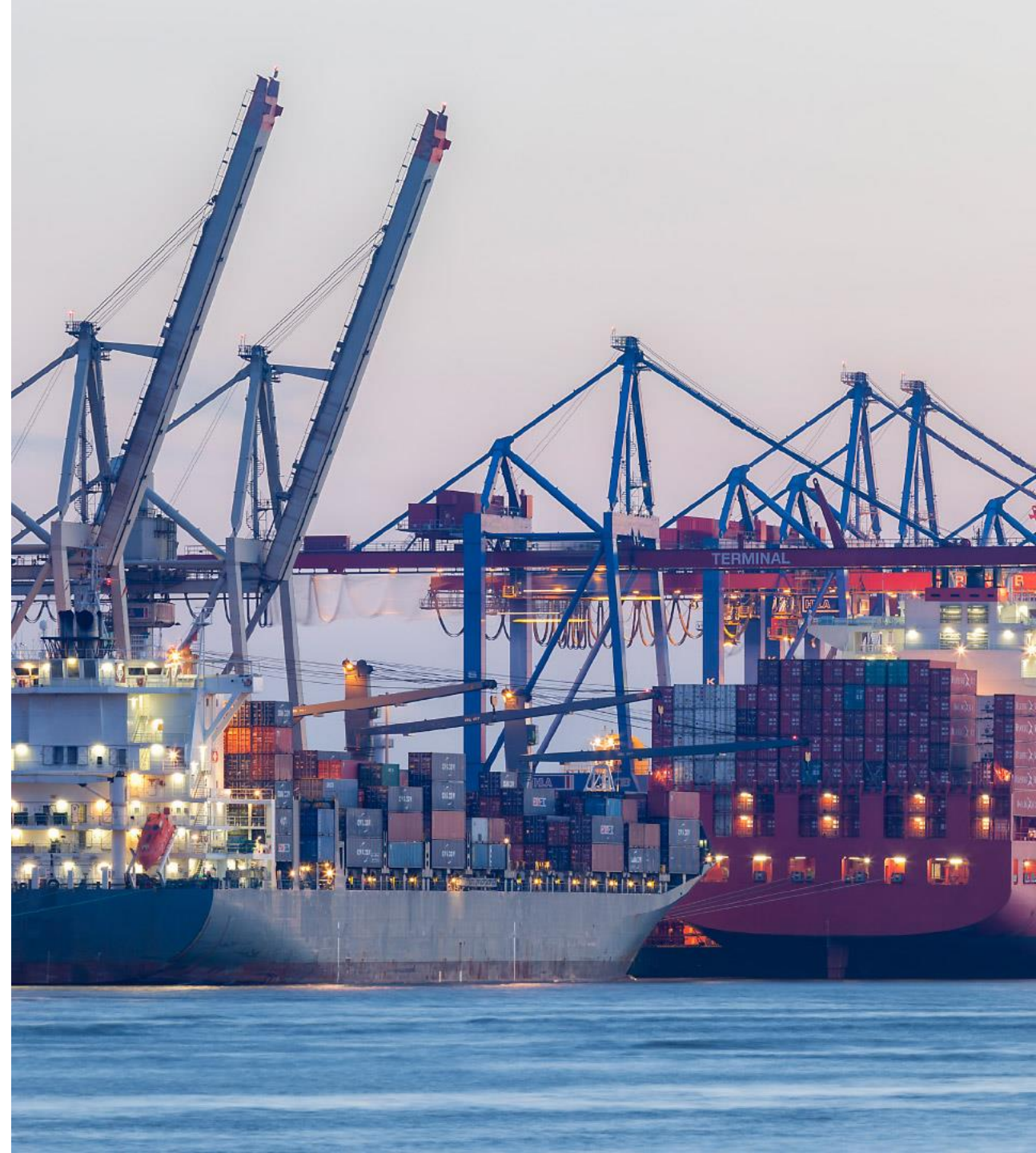


Wet damage	40.6%
Temperature damage	20.3%
Lost overboard	10.6%
Physical damage	7.7%
Deterioration	3.8%
Unclaimed cargo	2.8%
Off-spec	2.8%
Other	11.4%



TopTier & IUMI

- ❖ Concerns raised due to expensive claims
- ❖ Marine insurers = one part of the puzzle
- ❖ Cooperation with all stakeholders → JIP
- ❖ Extreme motions = one priority



Going Forward



- Extreme motions = priority!
- But: All root causes must be addressed
- Mandatory rules & enforcement
- TopTier findings to inform regulatory process



Thank you

Hendrike.kuehl@iumi.com



IUMI

AGENDA



Time (CET)	Topic
09:00 – 09:30	<i>Registration & Coffee</i>
09:30 – 10:00	TopTier overview
10:00 – 10:40	Avoiding 'major off-design' container losses
10:40 – 11:00	Panel discussion
11:00 – 11:30	<i>Coffee break</i>
11:30 – 12:10	Avoiding 'modest in-design' container losses
12:10 – 12:30	Panel discussion
12:30 – 13:00	TopTier follow up pitches / Open floor
13:00 – 14:00	<i>Lunch</i>

Waar komen al die duizenden tuinkabouters op het Amelandse strand vandaan?

Al jaren vinden jutters op Ameland tuinkabouters op het strand. Het gaat om duizenden exemplaren. Niemand weet waar ze vandaan komen. Een zoektocht naar hun herkomst leidt via een Zeeuwse tuinkabouterverzamelaar naar de tuinkaboutelhoofdstad van China.

Op 9 februari 2006 was de Mondriaan van het Britse Southampton onderweg naar de haven van het Duitse Hamburg toen het rond 6 uur 's avonds zo'n 15 kilometer boven Terschelling in de problemen kwam. Het was slecht weer waardoor er volgens de kustwacht 58 grote containers (40 voet lengte) overboord gingen.





30-11-20 - ONE Apus
- lost: 1823



25-10-21 - Zim
Kingston - lost: 109



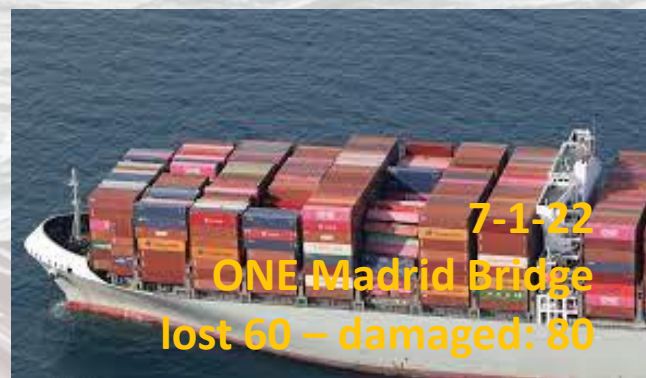
12-7-24 - CMA CGM
Benjamin Franklin
lost 44



24-3-25 - MSC Houston V -
lost: 15



21-1-21 - Maersk Essen -
lost: 727



7-1-22
ONE Madrid Bridge
lost 60 - damaged: 80



18-8-24 - CMA CGM Belem
lost 99



28-8-24 -
MSC Antonia -
lost: 46 damaged 305



29-1-21 - MSC Aria - lost: 41

© Theo Thomson
MarineTraffic.com

05/03/2020 15:27



10-2-21
Maersk Eindhoven
lost 260 - damaged: 65

© Andrew Mackinnon
MarineTraffic.com



24-3-22
Maersk Dyros
lost 90 - damaged: 100



7-3-25 - SM Portland -
lost: 115

SOURCES OF LOSS

- Out of design motions (like parametric roll)
- Mis-allocation of containers
- Degradation of containers and lashing material
- Small safety margins (corner post strength)
- Missing Twistlocks/lashes



South Africa August 2024

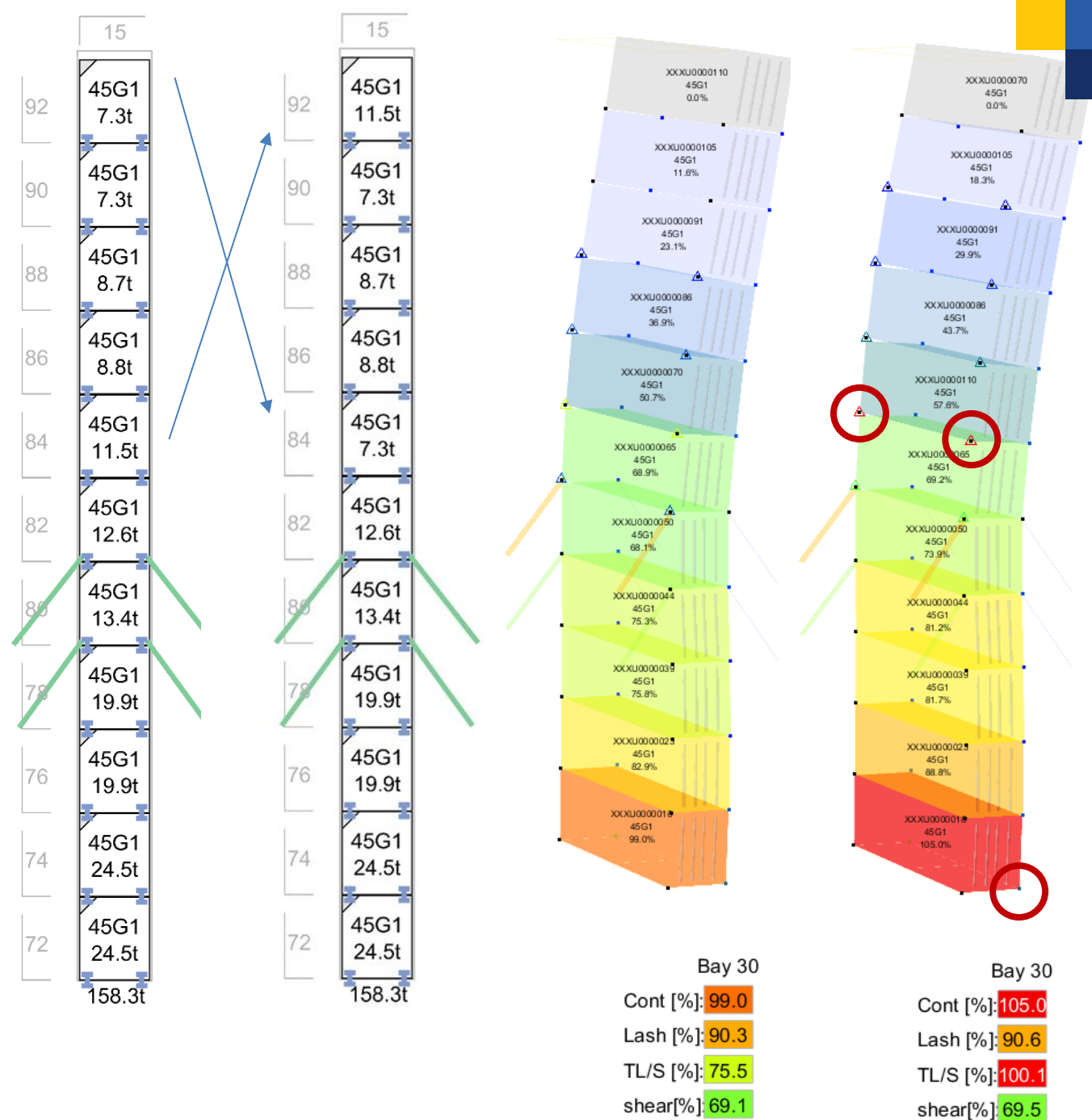
SOLUTIONS

- Lots of data available
 - EDI/BAPLIE Loading file
 - Ship motions
 - Wave and weather forecast

- Rerouting

- Good seamanship

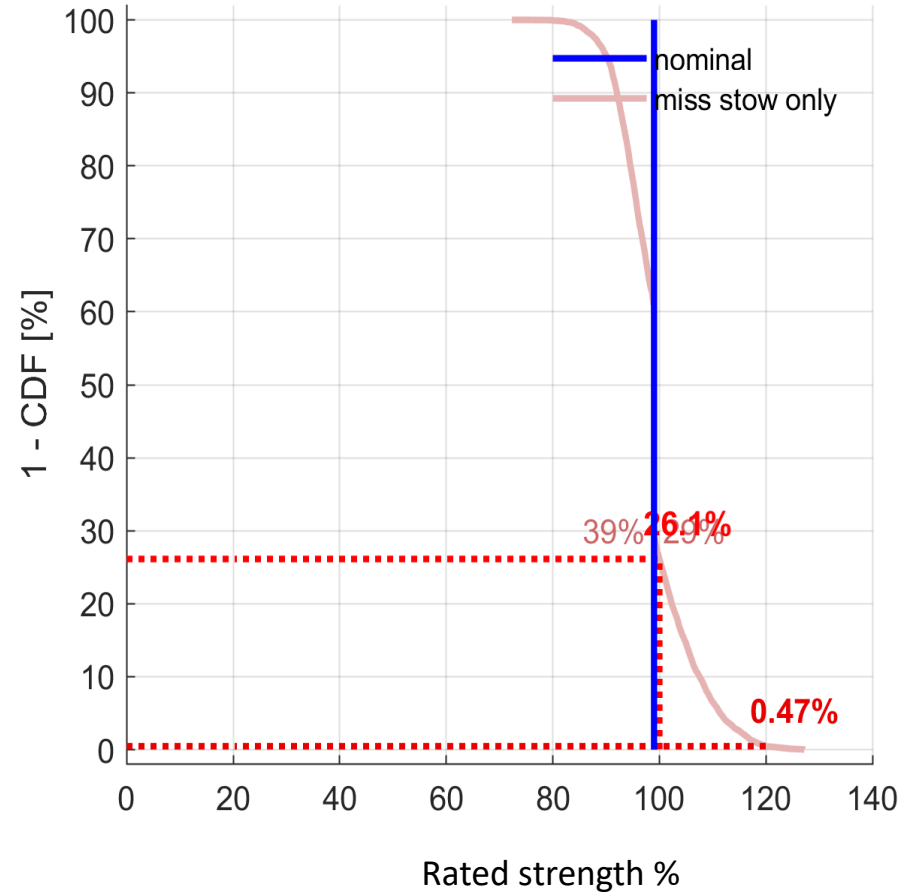
- Up-to-date Tools

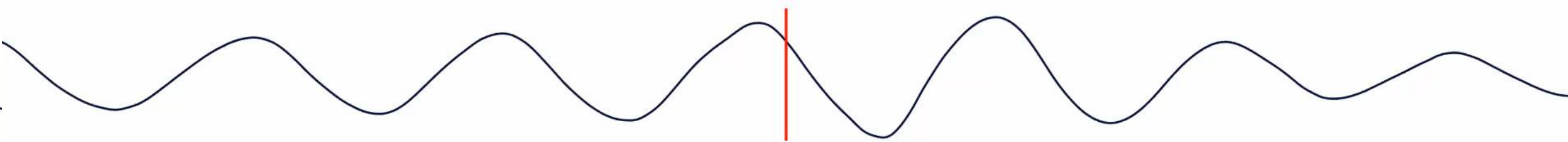
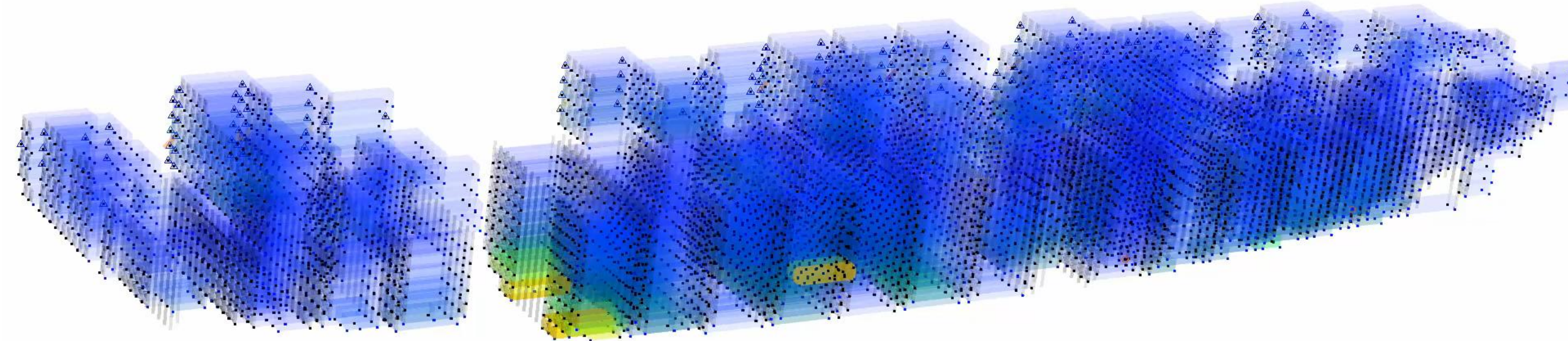


OPPORTUNITIES



Corner post compression





	Bay 82	Bay 78	Bay 74	Bay 70	Bay 66	Bay 62	Bay 58	Bay 54	Bay 50	Bay 46	Bay 42	Bay 38	Bay 34	Bay 30	Bay 26	Bay 22	Bay 18	Bay 14	Bay 10	Bay 6	Bay 2
Cont [%]:	41.0	38.9	53.5	44.2	45.6	79.9	61.0	47.3	68.6	77.3	63.9	44.9	63.4	51.2	53.2	48.8	63.3	52.5	55.3	34.1	24.4
Lash [%]:	33.2	28.8	96.3	87.4	33.7	0.0	77.8	58.6	50.1	96.7	79.3	99.6	79.0	95.1	49.8	49.9	36.1	50.0	30.2	38.5	20.3
TL/S [%]:	10.1	0.0	40.2	35.5	6.3	0.0	31.7	1.0	16.5	40.4	31.2	40.5	21.8	100.0	14.6	8.4	6.9	100.0	1.0	0.0	0.0
shear[%]:	36.3	38.0	35.4	38.5	29.3	10.9	40.7	36.9	31.7	35.1	42.2	37.2	49.4	47.8	27.9	29.0	35.3	49.3	32.2	30.3	25.6

GBMS System on board

System Capabilities

Intelligent Sensor Network

One or more sensors onboard measure real-time ship motions

Advanced Computational Analysis

High-precision force calculations for container stacks

Seamless Visualization

Accessible from any onboard computer

Shore-Based Connectivity (Optional)

Remote monitoring & expert guidance

Comprehensive Data Storage

Enables hindcast analysis & compliance reporting

Effortless Installation

- **Minimal Downtime**
Only 4 hours during routine port stopovers
- **Flexible Deployment**
Can be installed anywhere on the ship
- **Non-Intrusive Design**
No sensors required on containers

Strategic Impact

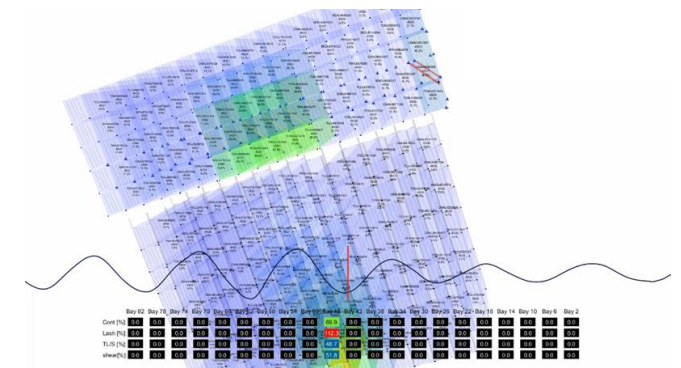
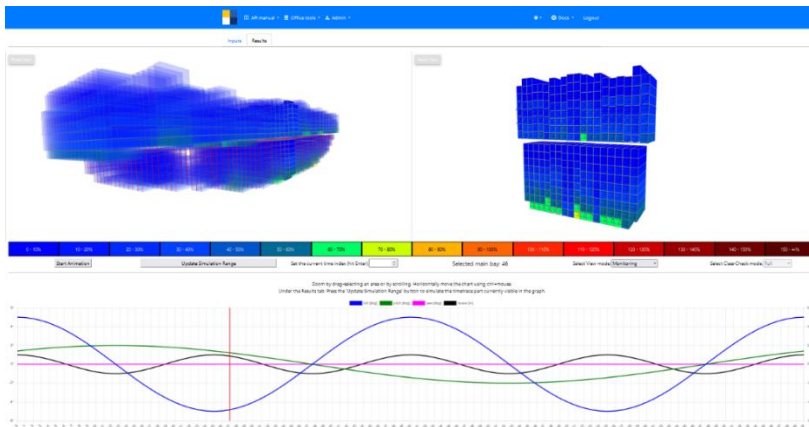
- Enhancing global maritime safety & sustainability
- Empowering data-driven decision-making for resilient supply chains
- Aligning with UN Sustainable Development Goals (SDGs) on safe & efficient shipping

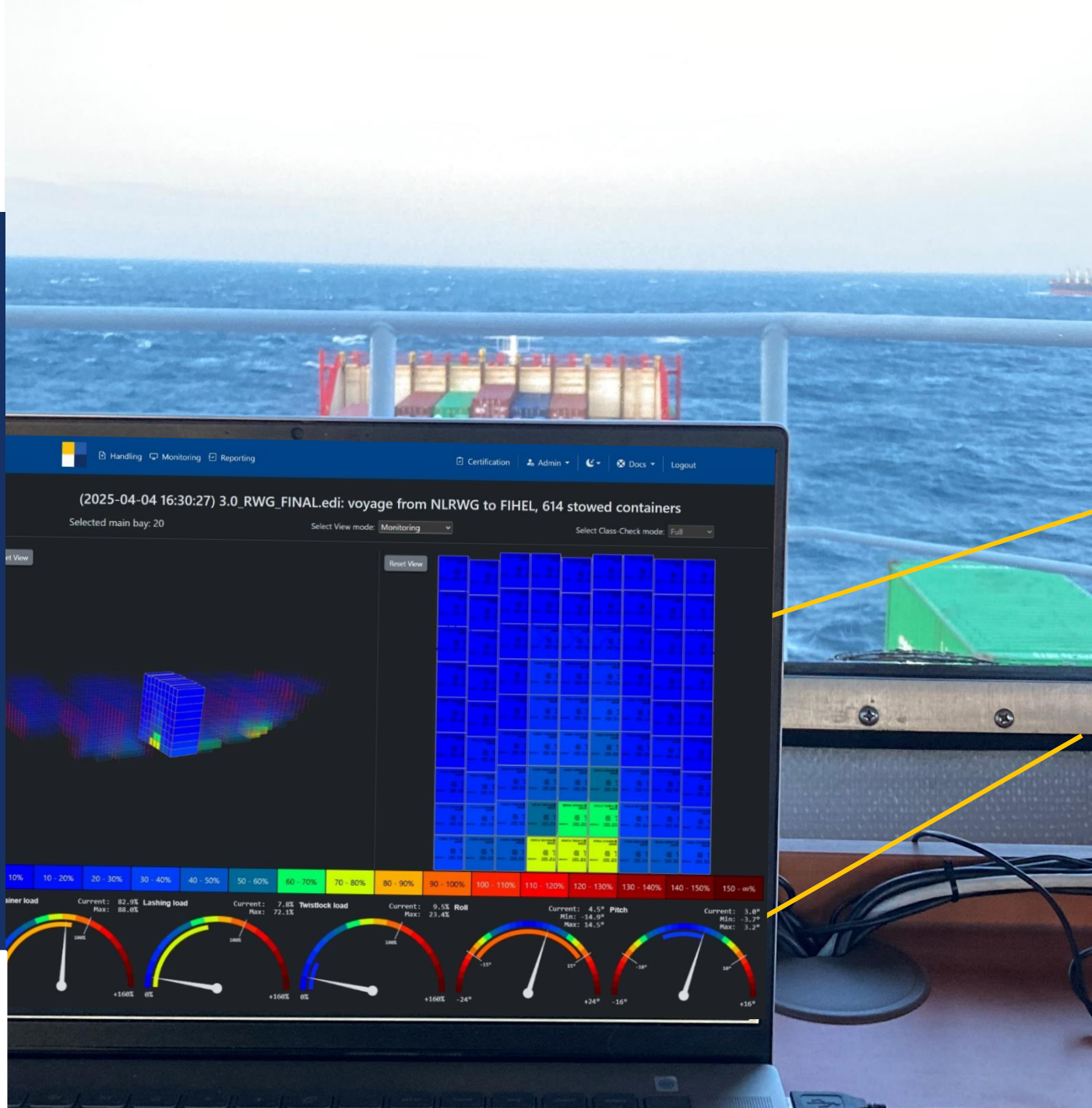


■ Intranet server for UI and real time calculation

■ Primary sensor

■ Optional additional sensors





SENSORIUMC

- Real-time monitoring of forces between the containers
 - Direct visualization at the bridge
 - Logging of ship motions for hind-cast analysis.
 - Single-sensor solution
-
- Crew is timely warned and can take evasive action



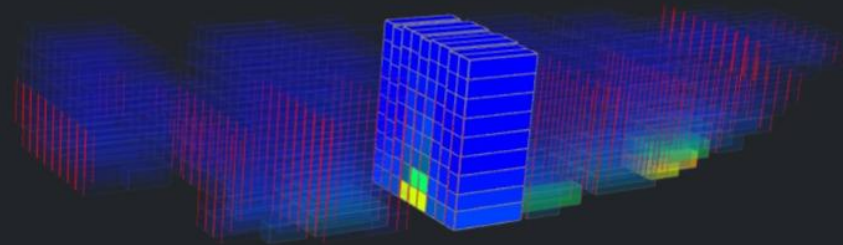
(2025-04-04 16:30:27) 3.0_RWG_FINAL.edi: voyage from NLRWG to FIHEL, 614 stowed containers

Selected main bay: 20

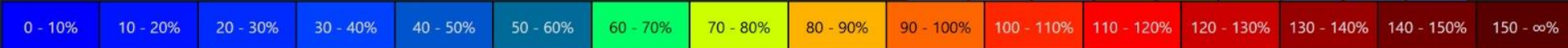
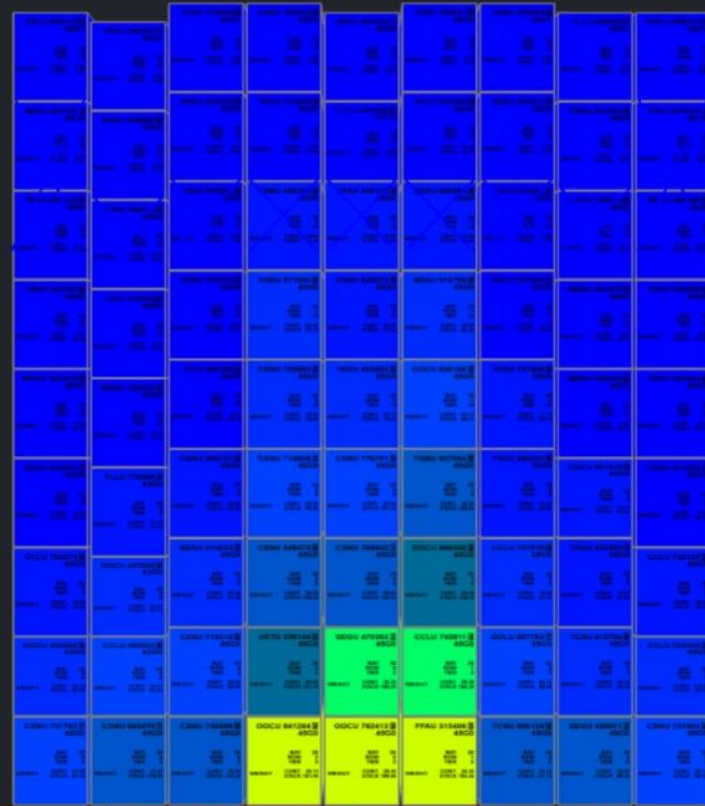
Select View mode: Monitoring

Select Class-Check mode: Full

Reset View



Reset View



Container load

Current: 82.9%
Max: 88.0%



Lashing load

Current: 7.8%
Max: 72.1%



Twistlock load

Current: 9.5%
Max: 23.4%



Roll

Current: 4.5°
Min: -14.9°
Max: 14.5°

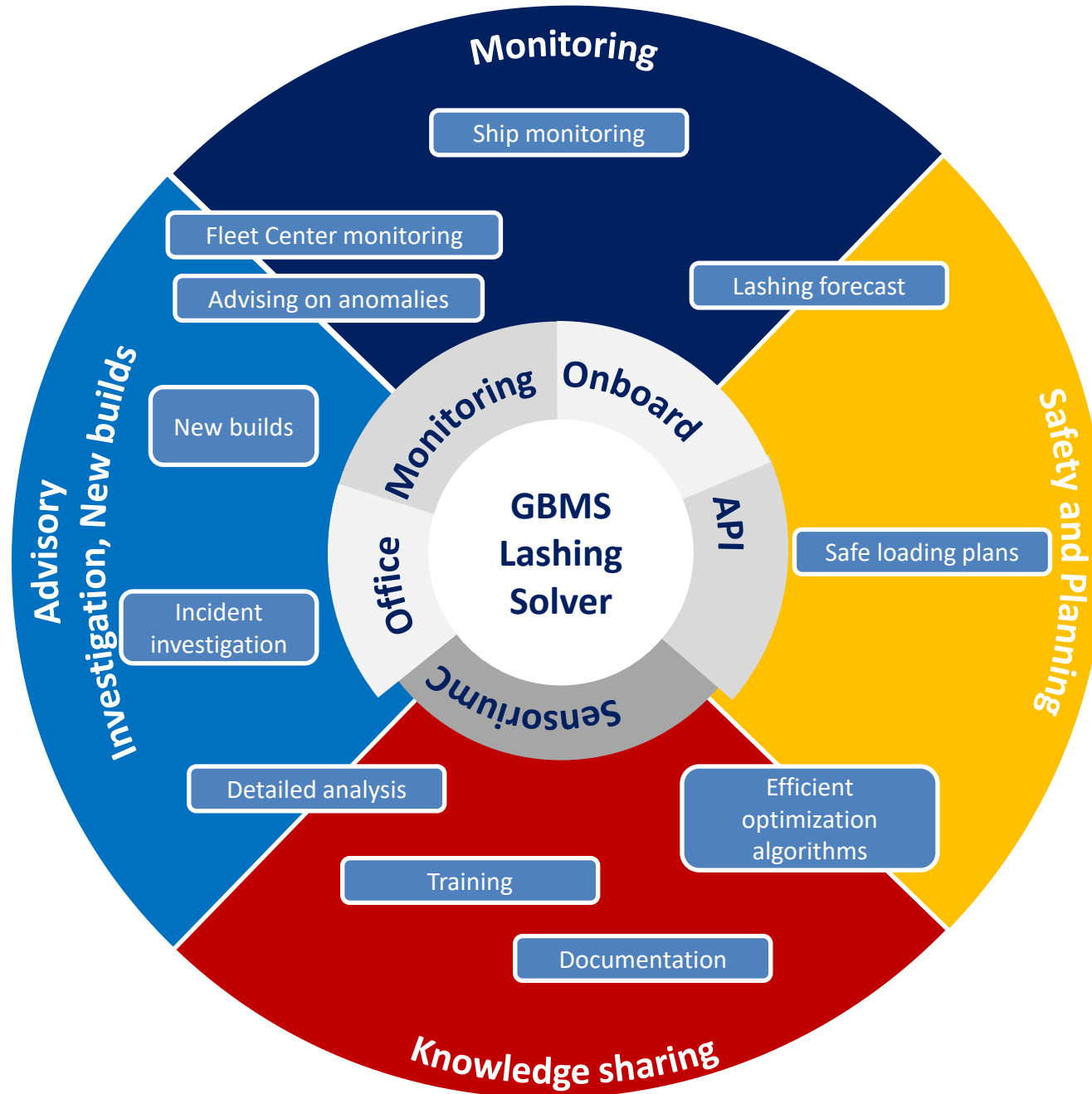


Pitch

Current: 3.0°
Min: -3.7°
Max: 3.2°



OVERVIEW



Crew experience

Dear All,

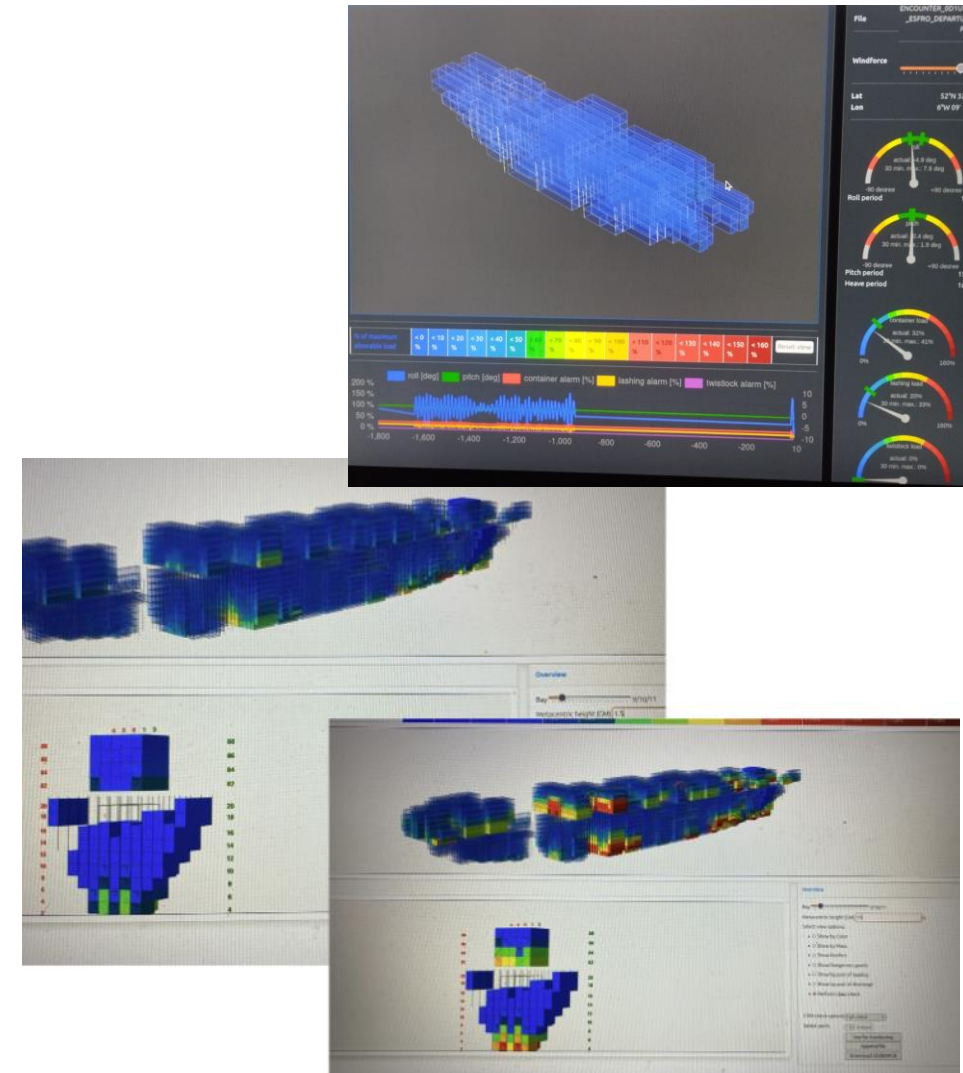
While we are crossing Biscay bay heading to North, from Ferrol, Spain to Dublin, Ireland.
Weather southerly wind force 8 bft (gusts of 9 bft), swell SW 4-5 mtrs, waves 4-5mtrs.
With a cargo load of 7108 mT, a GM that is 1.00 metre and rolling period of 14.6 seconds.

Our experience with GBMS container monitoring system is amazing.

The program shows the real time movement of our vessel on the screen as we monitor the container load, lashing and twist lock load. Very significant source for route evaluation to insure the safety of cargo and particularly in stormy condition.

Please find attached some pictures and video.

Best Regards,
Nilo - Captain - MV Encounter



GBMS

Reducing container
damage and loss



**Thanks for your
attention!**

Why Digitalize Lashing Gear?


- Manual, blind, and disconnected components
- No real-time inventory or condition tracking
- Failure risk with safety and operational impact




Some of Today's Pain Points

- Lost or misplaced twistlocks and lashing bars
- No real maintenance logs – visual checks only
- Crew size and time make full inspections unrealistic
- Logs often don't reflect the actual condition onboard
- Ships sail without knowing the true lashing status – but still sign off as “safe state”

The Smart Future

- Digitally enabled twistlocks and lashing gear
 - Cloud-based inventory and maintenance tracking
 - Each twistlock or other lashing component becomes part of a digital twin – enabling real-time monitoring and lifecycle tracking
 - Predictive maintenance and enhanced safety
- 
- The background of the slide is a composite image. On the right side, there is a photograph of a large container ship at night, illuminated by its own lights and the lights of a port. The ship is viewed from a low angle, showing its deck stacked with colorful containers. Overlaid on this image is a digital network of glowing blue lines and nodes, representing data flow or a digital twin. The overall color palette is dominated by blues and teals, with some red and white from the ship's lights.

Stakeholder Value – Beyond Operations

- Carriers– Inventory control, safety, operational efficiency and visibility
 - Crews – Faster workflows, less guesswork, safer working conditions
 - Fleet Managers – Remote condition visibility, global lifecycle tracking
 - Ports/Terminals – Faster handovers, smoother coordination, digital audit trail
 - Insurers – Access to hard data supports lower premiums and risk-based pricing
- 

A Digital Twin

- Real-time data from tagged lashing gear
- Centralized cloud view of all lashing assets
- Maintenance and lifecycle records always available
- Supports smarter inspections, less downtime

Data as a Strategic Asset

- Actionable data improves maintenance and inspection workflows
- Shared visibility enables smoother stake holder coordination
- Lifecycle logs support safety audits and compliance checks
- Insurers can use data to reward low-risk, data-rich fleets
- Lashing gear becomes part of your digital ecosystem

Maritime Supply Chain Risk Awareness

Prepared for MARIN Solutions
April 2025



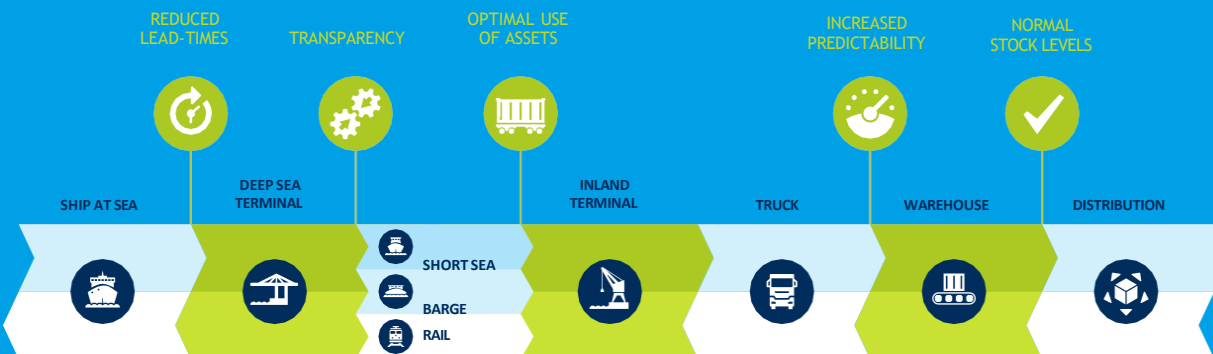
Overview & Structure

- 1. Introduction**
- 2. Risk Assessment & Preparedness**
- 3. Safety Responsibilities Overview**
- 4. Areas for Improvement**
- 5. Annexes & Discussion Points**

Introduction

“The new container cargo supply chain is clear. Consignors want transparency, predictability, and availability in the chain.”

Added to these requirements is a new demand: trusted partners





Consignors or Shippers and Freight Forwarders expect:

Client Expectations

Consignors and Freight Forwarders require transparency, reliability, and timely access across the supply chain

Digitalisation & Efficiency

Digitalisation is key to improving efficiency, reducing costs, and supporting sustainable logistics.

Geopolitical Pressure

Rising geopolitical concern demands are pushing the logistics sector towards more secure operations.

Digital Consultancy as Standard

Digital Consultancy is becoming a core expectation in freight forwarding services.

Driving Industry Change

Consignors, Shippers and Forwarders play a leading role in steering the industry to meet evolving customer demands.

Cargo is leading.

What remains critical in the Supply Chain ?

1. Heavy Incidents and Calamities in the Maritime Part of the Supply Chain
2. Risk Management of the Maritime Part of the Supply Chain.
3. Environment Safety Security Sustainability
4. Transport Transparency
5. Integrated Management System between Supply Chain Actors.
6. Efficiency Costs

Today's Objectives:

- Protect human life, property, and the environment.
- Strengthen process discipline and accountability.
- Improve and re-design integrated processes in the maritime industry.
- Create [(hi-tech) + (digital) + (smart) - (human error)] = cost & efficient cargo logistics

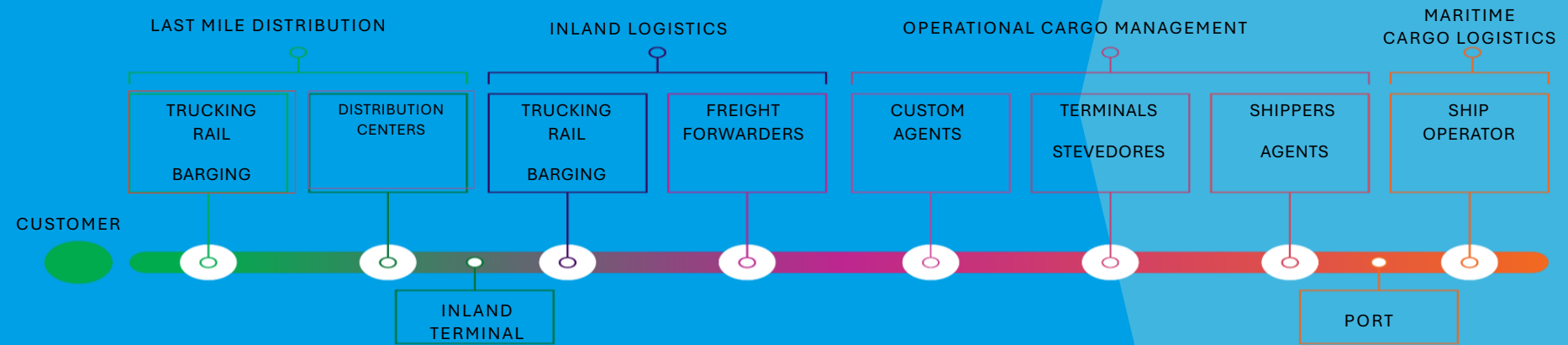
Some Direct Practical Examples:

- a. Standardised and Transparent Supply Chain Risk Assessment
- b. Human Factors Monitoring (Training, Drills, Certifications, Learning and Awareness)
- c. Advanced digitalisation
- d. Emergency Response and Preparedness
- e. Enhanced Equipment Inspections (Containers, Lashing and Securing)
- f. Controlled Maintenance Monitoring Programs

Risk Assessment & Preparedness

1. Identify Key Hazards & Vulnerabilities
2. Use and Develop Industry Standards
3. Develop and Implement Tools
4. Ensure Education and Training for all supply chain staff
5. Secure essential resources and data verification tools for secure communication
6. Digitalisation.
7. Smart Tools, Sensors, Dashboards, Tracking Tracing, Automated Reports

Safety Responsibilities Overview



1. Consignors: Accurate information & VGM declaration
2. Loading Stations: Correct Packing & Securing
3. Transporters: Condition verification & safe transport
4. Terminal Ship Planners: Stowage Planning & Compliance
5. Ship Command: Vessel Compliance Checks & Cargo Compliance Checks
6. Ship Operator: Vessel Compliance, Planning & Cargo Compliance Checks

Areas for Improvement

1. Human Factor & Process Discipline
2. Digitalisation & Transparency / Implementation Global Cargo System
3. Equipment Inspection & Maintenance
4. Governance & Accountability / Including Competent Authorities
5. Integrated Management Systems with tools and functionalities
6. Real-time data availability between Actors
7. Certified Operators based on ITL standards



TopTier open meeting

8 April 2025

Time (CET)	Topic
09:00 – 09:30	<i>Registration & Coffee</i>
09:30 – 10:00	TopTier overview
10:00 – 10:40	Avoiding 'major off-design' container losses
10:40 – 11:00	Panel discussion
11:00 – 11:30	<i>Coffee break</i>
11:30 – 12:10	Avoiding 'modest in-design' container losses
12:10 – 12:30	Panel discussion
12:30 – 13:00	TopTier follow up pitches / Open floor
13:00 – 14:00	<i>Lunch</i>

Please note there are only limited seats available and that you can follow the meeting online as well ([zoom link](#)). Register at registrations.marin.nl/blueweek-2025

Venue: MARIN, Haagsteeg 2, 6708 PM Wageningen

For questions; Toptier@marin.nl



BETTER SHIPS, BLUE OCEANS

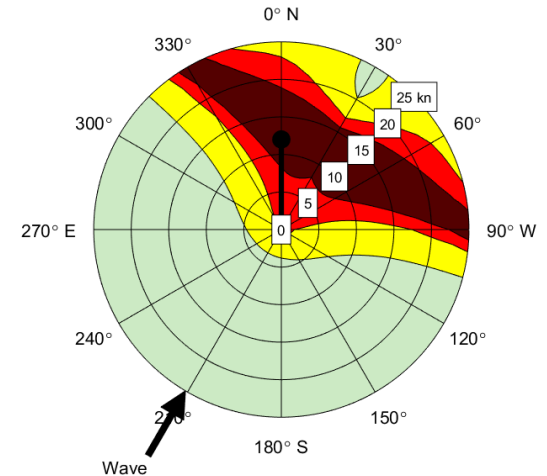
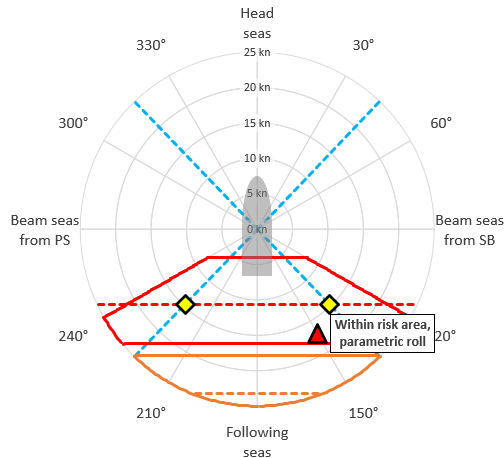
TopTier Follow-up

Operational guidance
Stay in-design and avoid off-design

The goal of this follow-up to TopTier is to mitigate the risk of extreme motions

We believe that collaboration among carrier companies, system developers, research institutes, training institutions, and others will accelerate this effort.

- TopTier showed that many factors contribute to loss of containers
- It is not easy to solve them all at the same time
- One of the easier short-term improvements is:
 - ***Operational guidance***



TopTier increased knowledge on preventing extreme roll



- TopTier working group 3 and 5 focused on extreme roll
- 85% of the container loss/damage in incident review
- *However, we should not forget the remainder...*

	Resonant roll	Parametric roll (stern)	Parametric roll (bow)	Head & bow quartering	Unknown	Total (%)
(Partial) stack collapse	0%	-	-	0%	0%	1%
Single (stern) bay collapse	2%	2%	1%	4%	3%	11%
Multiple stern bay collapse	2%	-	1%	-	0%	4%
Multiple bay collapse	11%	41%	23%	-	6%	81%
Unknown	1%	-	0%	0%	2%	4%
Total [%]	16%	43%	26%	4%	11%	100%

- Should include all weather induced phenomena that cause container loss or damage
 - Roll and transverse accelerations
 - Vertical motion and accelerations
 - Wind loads & wave impacts
 - Slamming, springing & stack resonance
- Sensitivity & uncertainty
 - Weather forecast
 - Motion prediction
- Onboard
 - Crew awareness
 - Implementation
 - Required input

	Stay in-design	Prevent off-design
Pro-active guidance		
Re-active guidance		

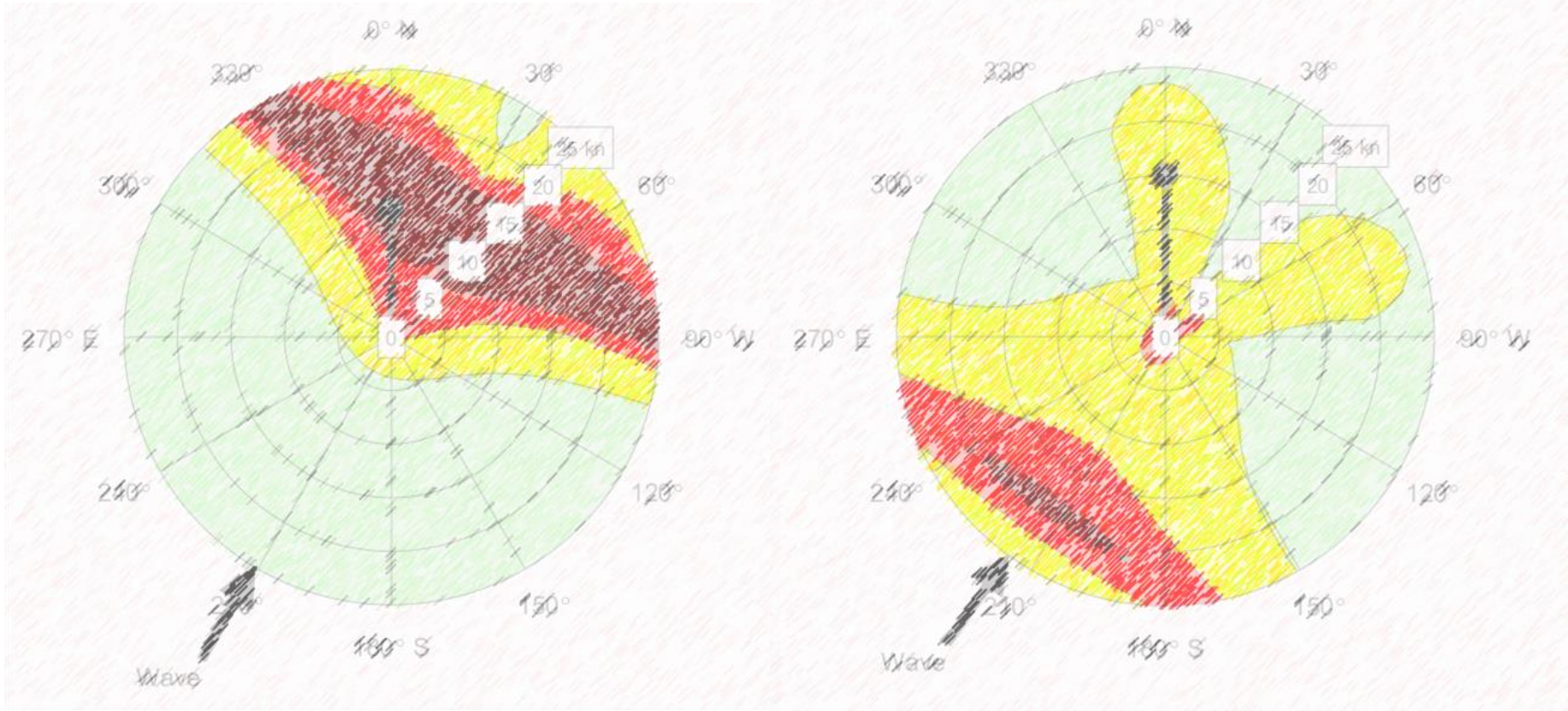
- 1) Create parametric roll training course material (awareness and effective procedures)
- 2) Establish practical guidelines for Operational Guidance (to help tool selection and to help tool development)

- Use the moving base simulator
 - evaluate generic features of interfaces and generalized procedures
 - evaluate the effectivity of awareness training
- Use TopTier data
 - evaluate the effectivity of algorithms (*incl e.g. false positives*)

- *With consideration of*
 - *Design motion (e.g. class or direct calculation)*
 - *SGISC operational guidance and MSC1228*

- 2 years
- Kick-off Q4 2025 (*Vessel Operator Forum*)
- contribution 10-20 k€/year

Thank you



For more info: w.pauw@marin.nl or r.grin@marin.nl

Public deliverables



Besides internal project deliverables some public information can be found on [TopTier | MARIN](#):

- **Video TopTier in-progress**
- **Notice to Mariners** - This information gives guidance on how to plan, recognize and act to prevent parametric rolling (videos, tool, notice)
- **CCC 9/INF.25 19 July 2023** - Update on the progress of the TopTier Joint Industry Project (JIP) on container losses
- **MSC 106/INF.16 30 August 2022** - Update on the progress of the MARIN TopTier Joint Industry Project (JIP) on securing container safety
- **Paper** - TopTier, seakeeping and container cargo securing safety, J. Koning, Proceedings of the 18th International Ship Stability Workshop, 13-15 June 2022, Gdańsk, Poland 1
- **Thank you note** including 13 main points of attention from Seafarer perspective
- **Status update** - January 2024
- **Report on Review of incidents** – R. Grin, May 2022.
- **Summary incident review and gap analysis** – J. Koning, June 2024.
- **CCC 10-11-5 11 July 2024** - Improvements to be considered for the safe transport, stowage and securing of containers
- **CCC 10/INF.17 11 July 2024** - Review of incidents resulting in loss of containers
- **CCC 10/INF.18 11 July 2024** - Summary of incident review and gap analysis
- **CCC 11 based on TopTier summary report** → expected July 2025

PARAMETRIC ROLL IN FOLLOWING SEAS

Input	
Vessel length in [meter]	330
Roll period in [seconds]	34
Uncertainty in roll or wave period [seconds]	3
Vessel speed in [knots]	15
Course of ship in [degrees]	330
Wave direction in [degrees]	300
Mean wave period in [seconds] or enter	10.2
Wave encounter period in [seconds] and Effective wave length in [meter]	10.2

Risk evaluation*	
Roll on rebarment roll	No
Risk parametric roll in (close to) head seas	No
Risk parametric roll in (close to) following seas	No

In this video we show how to recognise and prevent parametric roll in following seas



SUB-COMMITTEE ON CARRIAGE OF CARGOES AND CONTAINERS
10th session
Agenda item 11

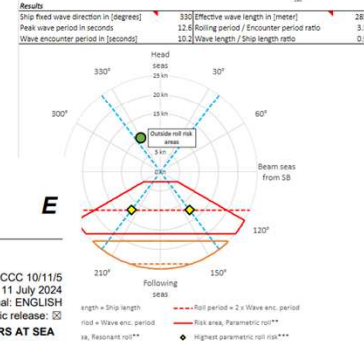
CCC 10/11/5
11 July 2024

Original: ENGLISH
Pre-session public release: ☑

DEVELOPMENT OF MEASURES TO PREVENT THE LOSS OF CONTAINERS AT SEA

Improvements to be considered for the safe transport, stowage and securing of containers

Submitted by Australia, Germany, Kingdom of the Netherlands, BIC, P&I Clubs, IUMI and WSC



SUMMARY	
Executive summary:	This document proposes improvements to be considered for the safe transport, stowage and securing of containers based on preliminary results of the TopTier project.
Strategic direction, if applicable:	7
Output:	7.20
Action to be taken:	Paragraph 14
Related documents:	MSC 104/17/4; MSC 106/INF.16; MSC 107/17/12; CCC 9/INF.25; CCC 9/13/3; CCC 9/13/4; CSC.1/Circ.143 and CSC.1/Circ.138/Rev.1

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