BRITANNIA P&I
TRUSTED SINCE 1855

The Britannia Steam Ship Insurance Association Limited

Container Stowage – Does it all stack up?

BRITANNIA P&I
TRUSTED SINCE 1855

Thursday 28 January 2021

Source: BSU/Netherlands Coastguard

Speakers/Panel

Graham Wilson
Loss Prevention Divisional Director, Britannia

Jacob Damgaard,
Loss Prevention Manager, Britannia

Simon Burthem
Chief Operating Officer, TMC Marine

Sebastian Brindley
Lead Specialist, Lloyd's Register

Igor Protsenko
Senior Software Engineer, Navis

Agenda

Container Stowage/Loss perspectives….

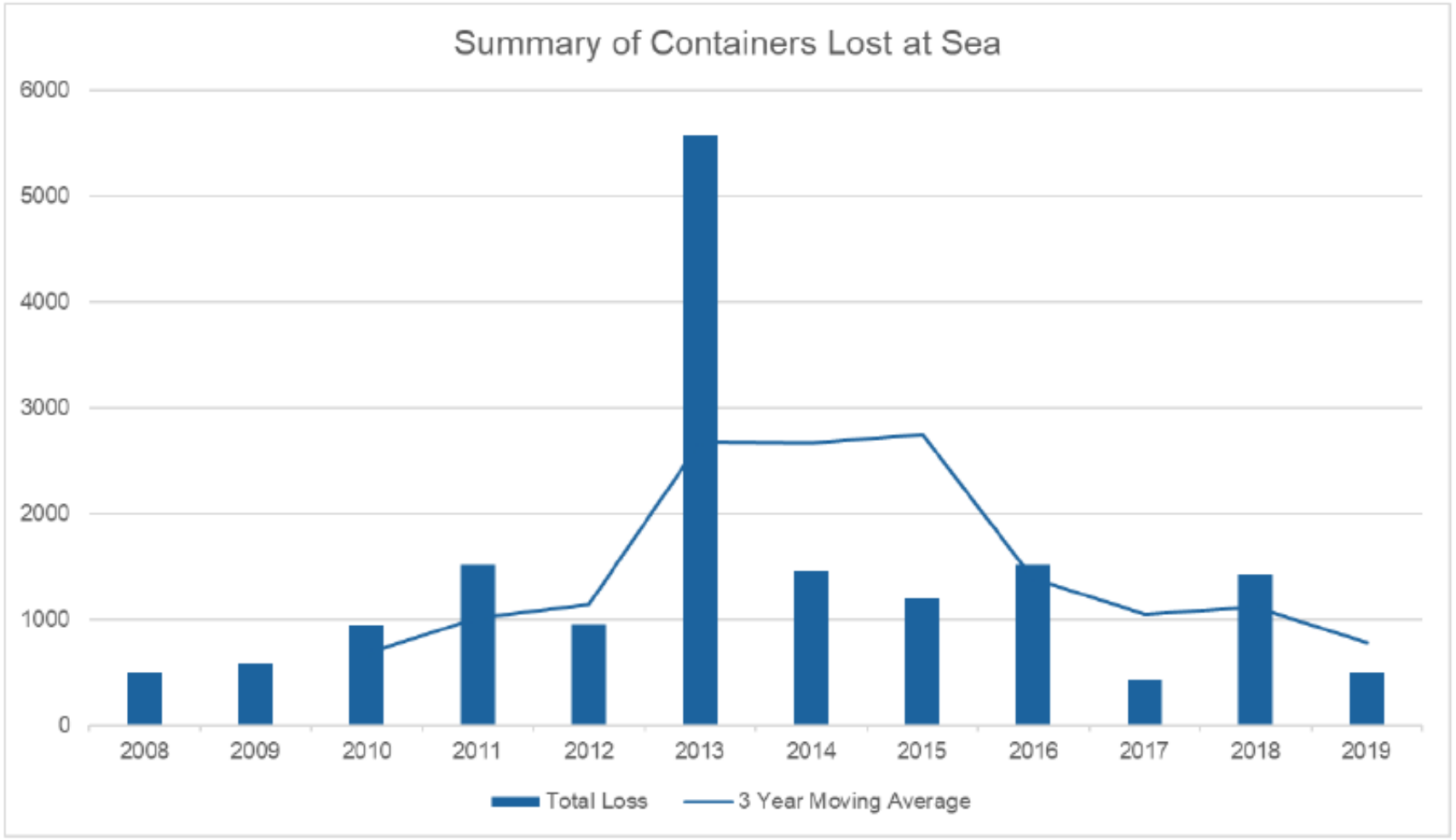
- P&I insurer – Jacob Damgaard
- Casualty investigator – Simon Burthem
- Regulatory/Class – Seb Brindley
- Stowage software – Igor Protsenko

Questions

Container Loss – from a P&I perspective

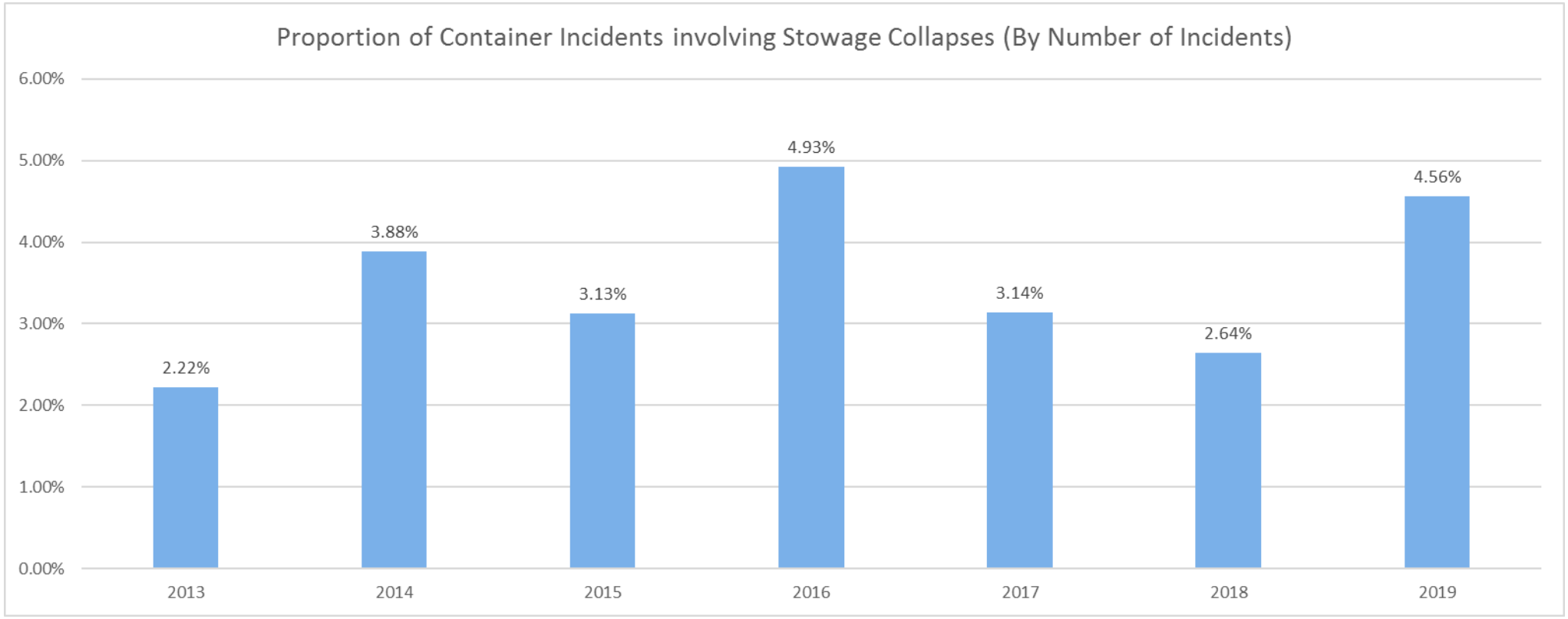
Jacob Damgaard - Loss Prevention Manager, Britannia

Container Loss – Statistics

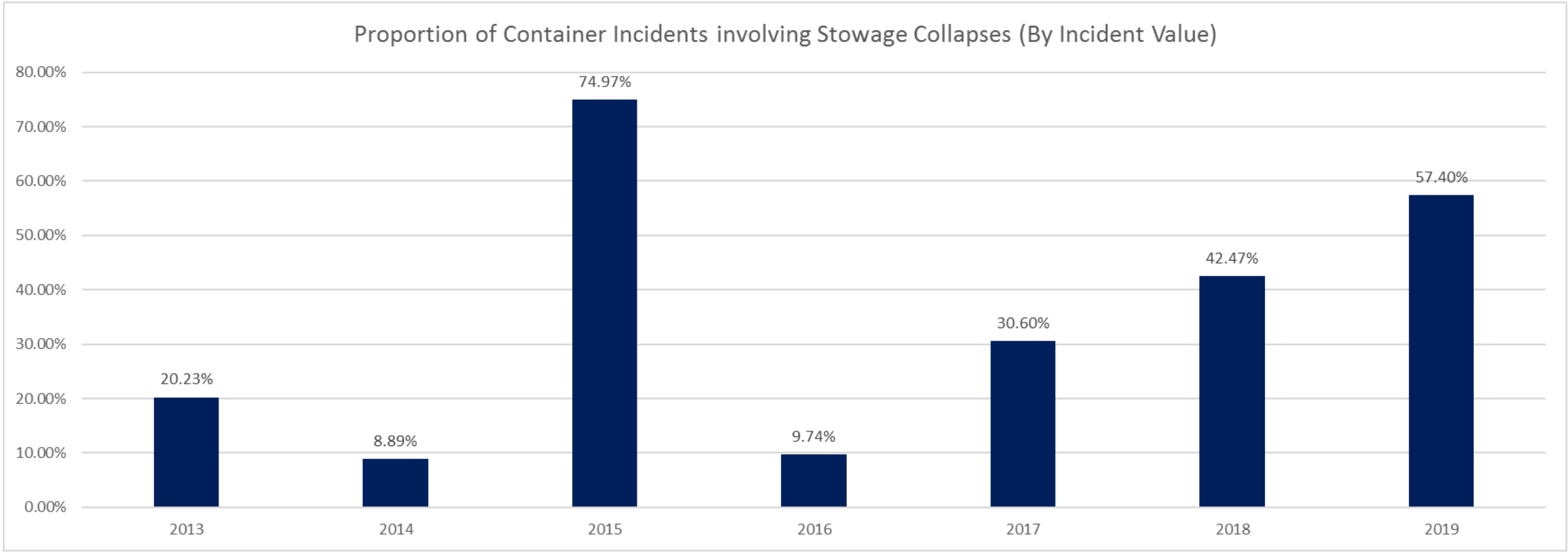


Source: World Shipping Counsel – Containers Lost At Sea – 2020 Update

Container Loss – Britannia Statistics



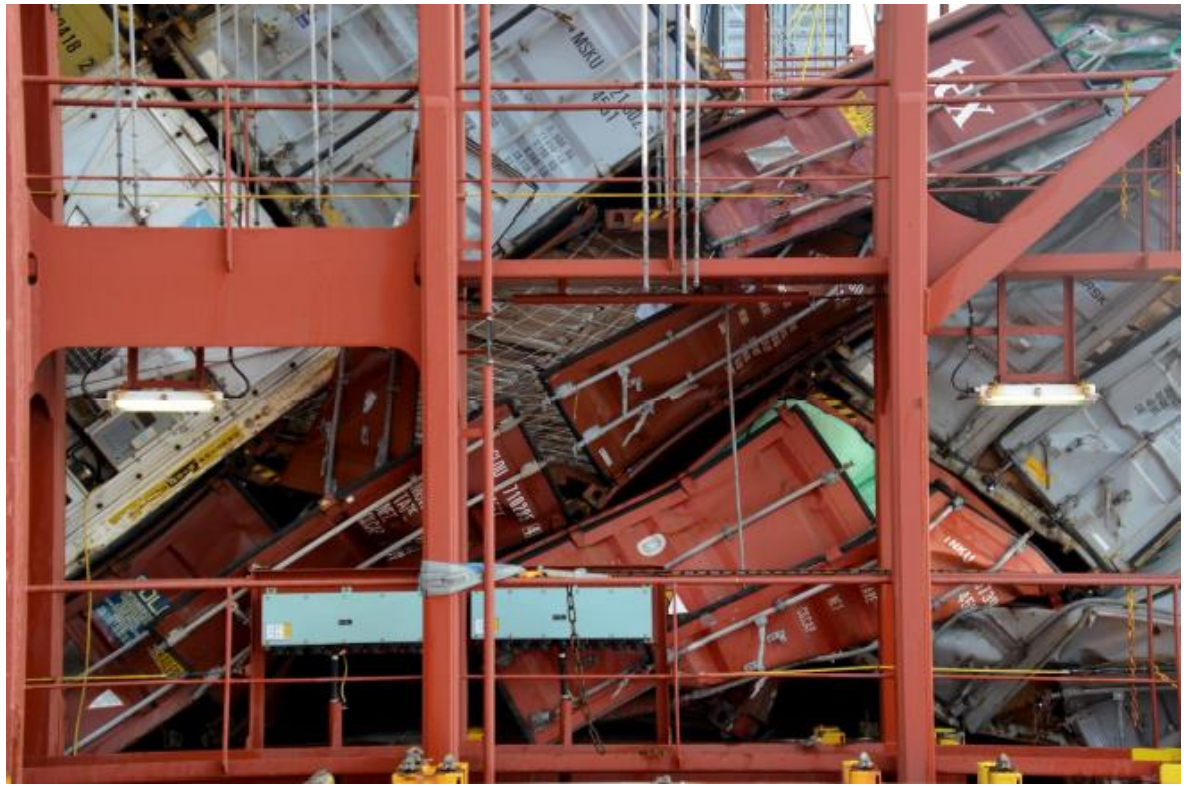
Container Loss – Britannia Statistics



Container Stow Collapse – Consequences?

Onboard Stow Collapse:

- Damage to cargo and ship
- Time consuming clean up
- Delay to ship and cargo
- Increased focus from authorities



Source: Federal bureau of Maritime Casualty Investigation of Germany – Loss of containers from MSC Zoe

Container Stow Collapse – Consequences?

Overboard Loss of Containers:

- Environmental impact
- Complicated and time consuming clean up
- Risk of escalating costs
- Damage to reputation

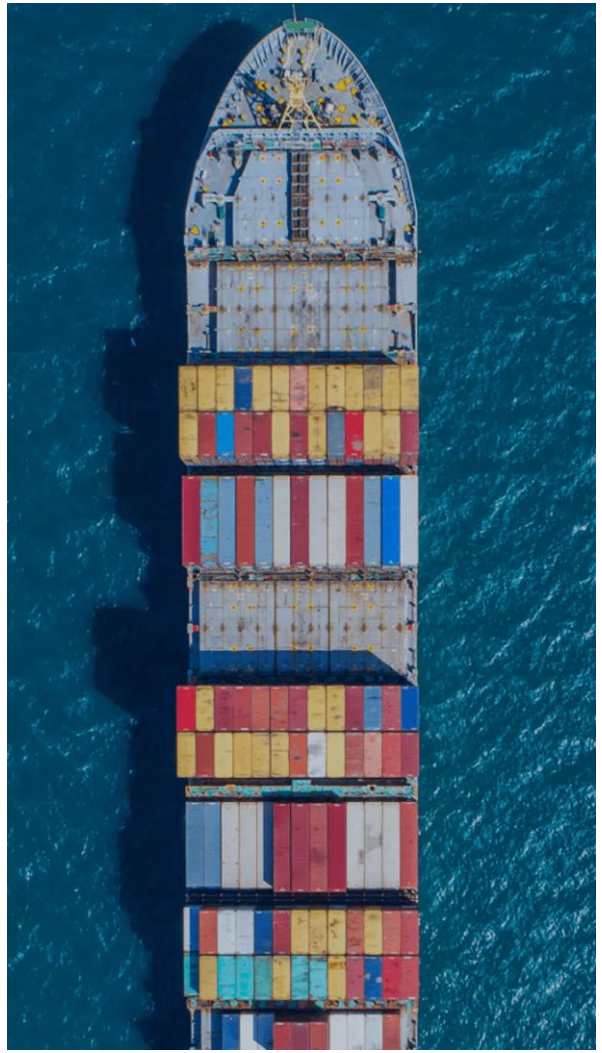
Source: The International Tanker Owners Pollution Federation (ITOPF)

Container Stow Collapse – What can contribute?

Several Contributing Factors:

- Weather impact
- Non–compliant stowage calculations/mis declared VGM
- Incorrect use of stowage software
- Incorrect application and checking of lashing gear
- Maintenance of lashing gear

No trends as to size of ships



Container Loss – An investigator's perspective

Simon Burthem - Chief Operating Officer, TMC Marine

The Causes of Container Stow Collapse

Why do container stowages fail?

The forces are **too high**

The lashing system is **too weak**

The scale of the problem

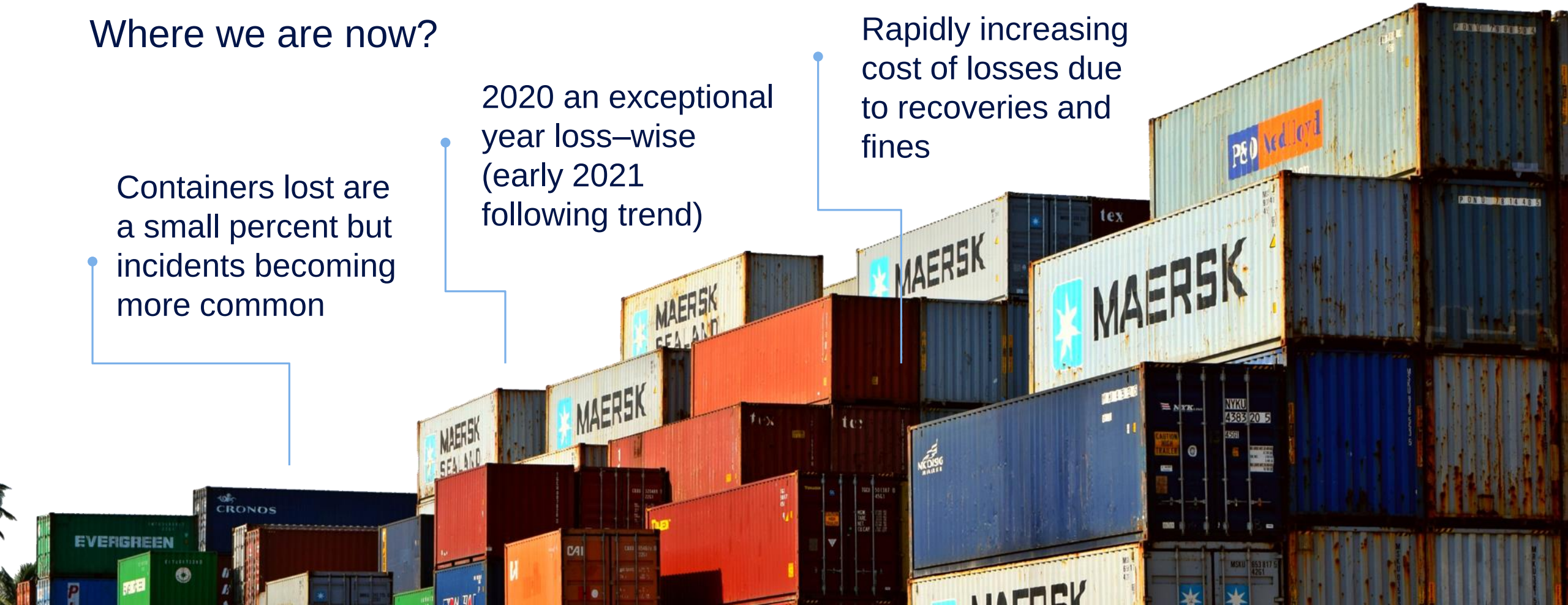
Containers **were** the solution

Where we are now?

Containers lost are a small percent but incidents becoming more common

2020 an exceptional year loss–wise (early 2021 following trend)

Rapidly increasing cost of losses due to recoveries and fines



Principles of Container Securing

Moving Vessel

Applied Force

Lashings overloaded

Result in stow collapse

Safe stowage is a balancing act between the **capability of the lashing system** and the **forces imposed during the voyage**

Causes of stow collapse

If the stow collapse is the symptom, how far back up the supply chain do the root causes go?

1. **Packing/ consignment**
2. **Planning and weight issues**
3. **Loading and lashing**
4. **Voyage planning**
5. **Voyage execution**

Packing/Consignment

- Cargo is not properly secured within container
- The CoG is very eccentric (too high, to one side or to one end)
- The cargo is not suitable for the container
- Net result an overloaded container shell and/or lashing system due to unpredictable and excessive stresses

Planning and Weight

- Exceed allowable stack weights
- Improper distribution of weights in stack
- Containers are heavier than declared
- No lashing analysis carried out at plan stage
- Stowage by discharge sequence
- High cube containers present larger windage and higher CoG

Loading and Lashing

- Containers in poor condition or damaged
- Lashings not fitted in correct configuration
- Lashings not properly locked or tightened
- Portable lashing components in poor condition
- Fixed lashing fittings in poor condition
- Use of Fully automatic twistlocks

Voyage Planning

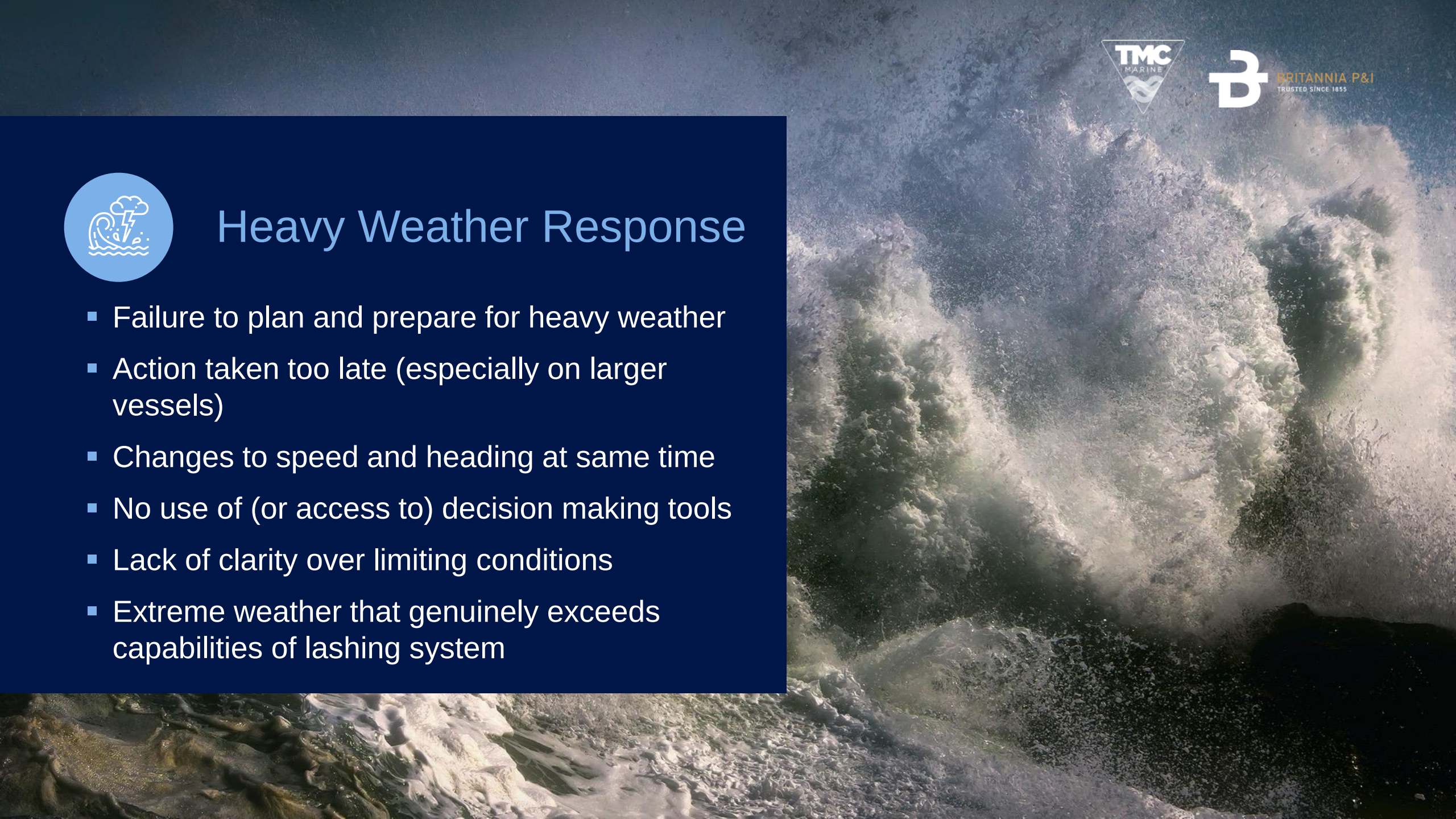
- Excessively high GM
- Larger GM than stow plan envisages
- Late changes to stowage plan and hot stows
- Insufficient means for lashing analysis
- Insufficient time for lashing analysis
- Empowerment of crew to request changes to stow

Voyage Execution

- Failure to monitor and re–tighten lashings during voyage
- Poor weather routeing – failure to avoid adverse weather
- Poor seamanship in face of bad weather
- Changes to ballast
- Engine breakdown or machinery failure

Heavy Weather Response

- Failure to plan and prepare for heavy weather
- Action taken too late (especially on larger vessels)
- Changes to speed and heading at same time
- No use of (or access to) decision making tools
- Lack of clarity over limiting conditions
- Extreme weather that genuinely exceeds capabilities of lashing system



The Master is responsible for safety of cargo:

"…the carrier shall properly and carefully load, handle, stow, carry, keep, care for and discharge the goods carried"

The causes of container stow collapse are complex and investigation requires the **use of specialist software and knowledgeable consultants**

TMC Marine

Set sail with confidence

The Requirements

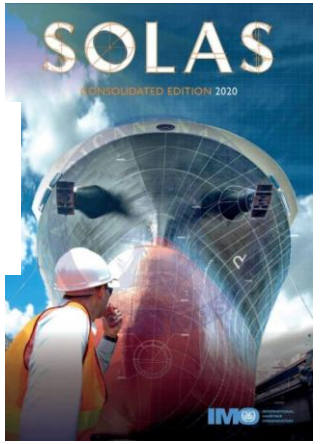
Seb Brindley - Lead Specialist, Lloyd’s Register

Requirements:

- Statutory
- Classification

Statutory Requirements

IMO – SOLAS Ch6 & Ch7

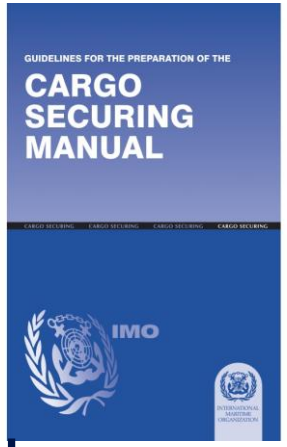


Chapter 6

- “If the shipping document, with regard to a packed container, does not provide the verified gross mass and the master or his representative and the terminal representative have not obtained the verified gross mass of the packed container, **it shall not be loaded on to the ship**.”

- “Stowed and secured throughout the voyage in accordance with the **Cargo Securing Manual**”

Statutory Requirements

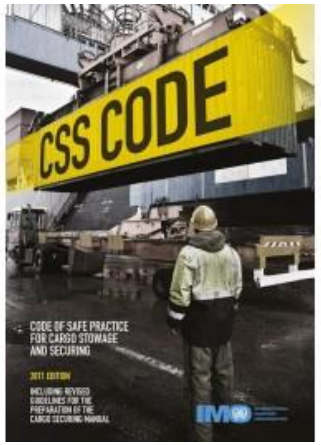


Cargo Securing Manual

- "…should be written in the working language or languages of the ship."
- "The guidance given herein should by no means rule out the principles of **good seamanship**, neither can it replace **experience** in stowage and securing practice"
- Specification for cargo securing devices & maintenance: Regular inspections and maintenance should be carried out under the **responsibility of the master**.
- Cargo Safe Access Plan (CSAP) – annex 14 of CSS Code

Statutory Requirements

Code of Safe Practice for Cargo Stowage and Securing



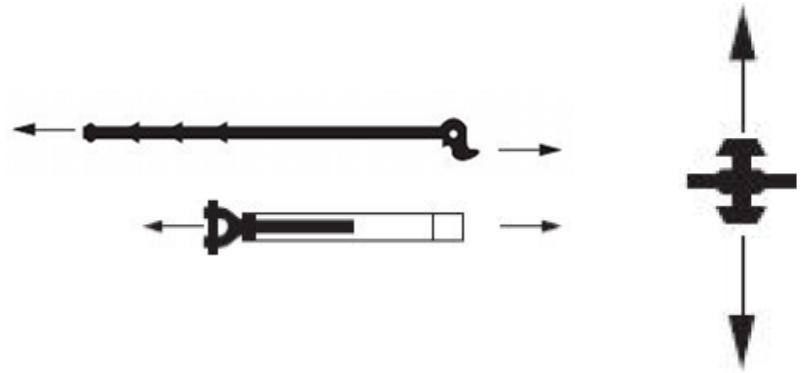
- “All cargoes should be stowed and secured in such a way that the ship and persons on board are not put at risk.”

- Ch6: “Offer some advice on how stresses induced by excessive accelerations caused by bad weather conditions could be avoided.”
  - Measures to avoid excessive accelerations
  - Voyage planning

Class Requirements

Cargo Securing Arrangements

- Test requirements for loose and fixed fittings
- Assessment of container arrangements



1. The expected motions the vessel will experience
2. Containers, loose fittings, twistlocks are in good working order and working effectively

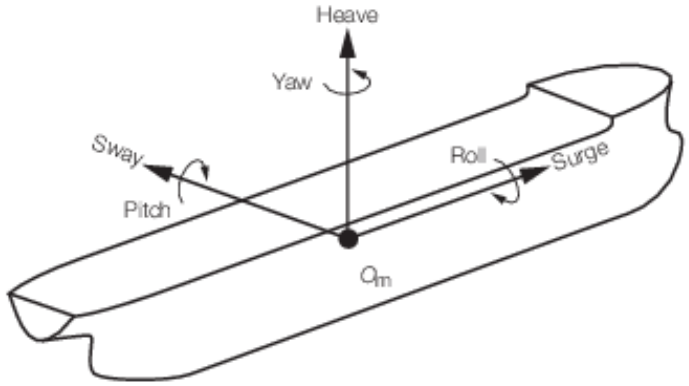
Class Requirements

Vessel Motions & Loads

- Roll, heave, pitch and wind

- Wind: 40m/s ~ 36m/s

- Roll: Small vessels ~ 30deg
  Medium vessel ~ 22deg
  Large vessel ~ 12deg



Controlling Ship Motions

Planning

- GM

Operation

- Course
- Speed

Operational Guidance

- Parametric Rolling
- Synchronous Rolling

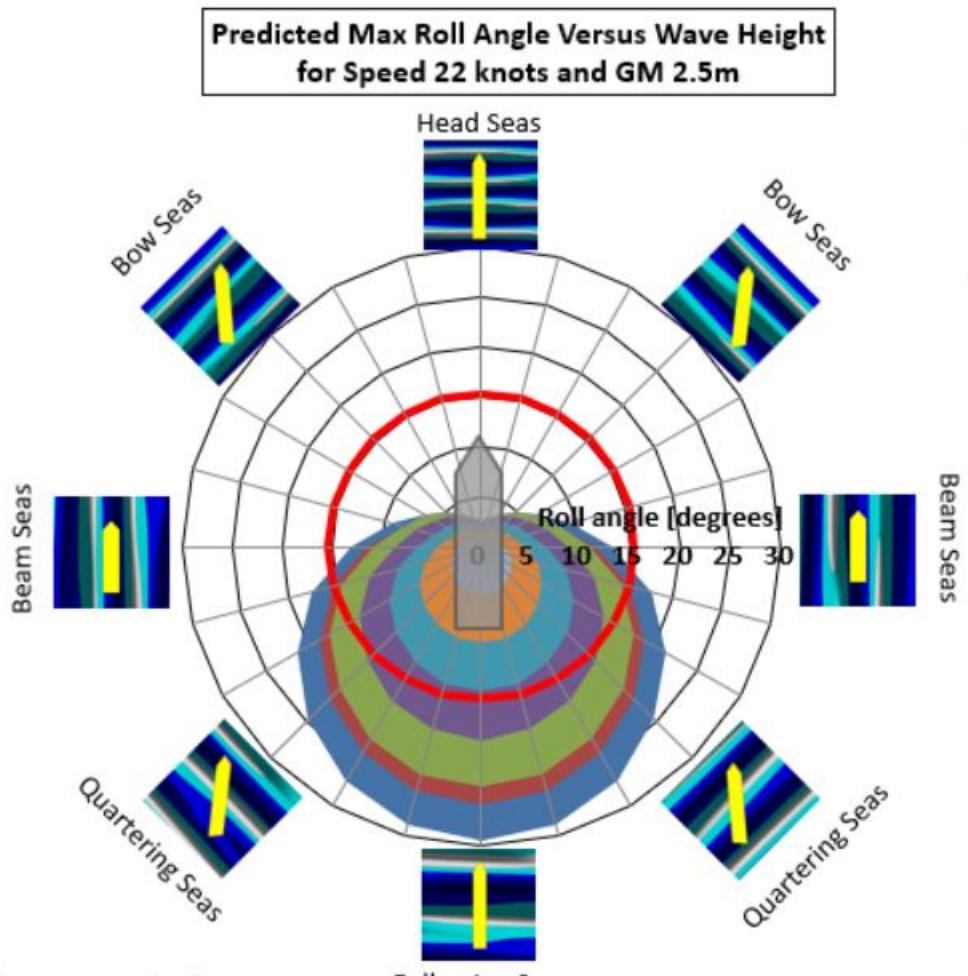


Chart shows expected roll in increasingly rough seaways

Controlling Ship Motions

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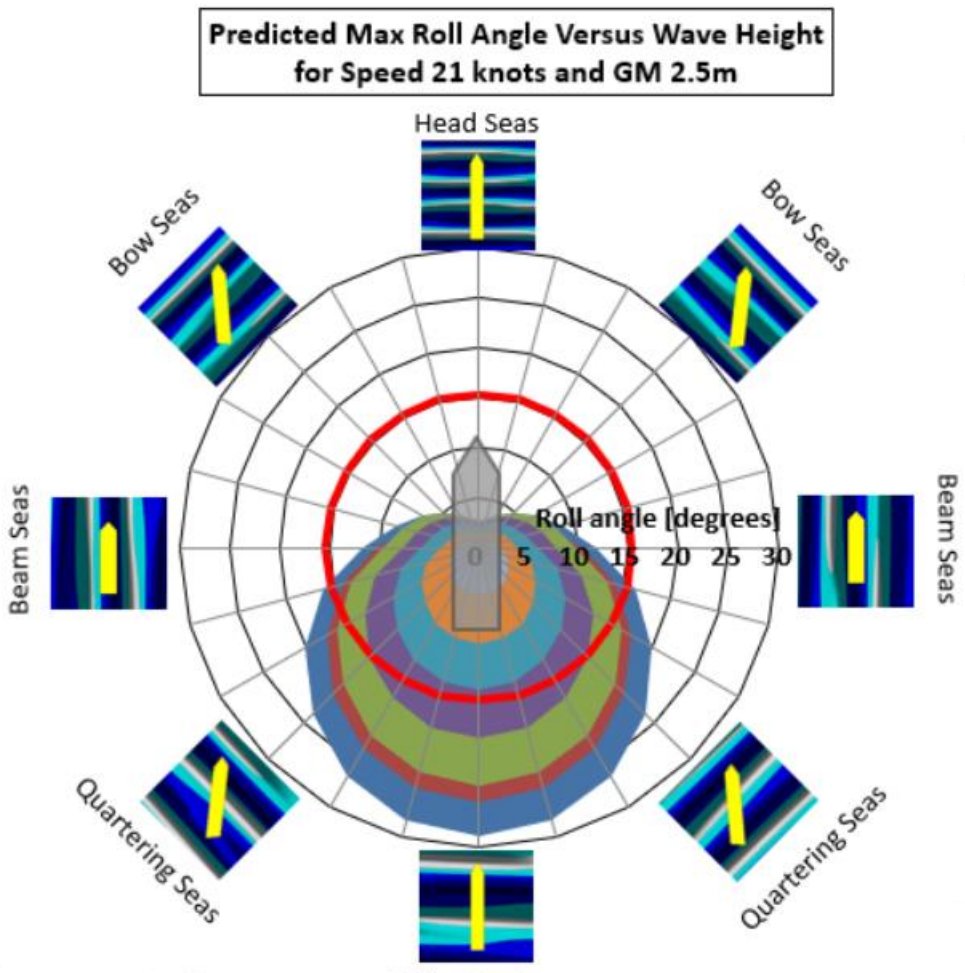

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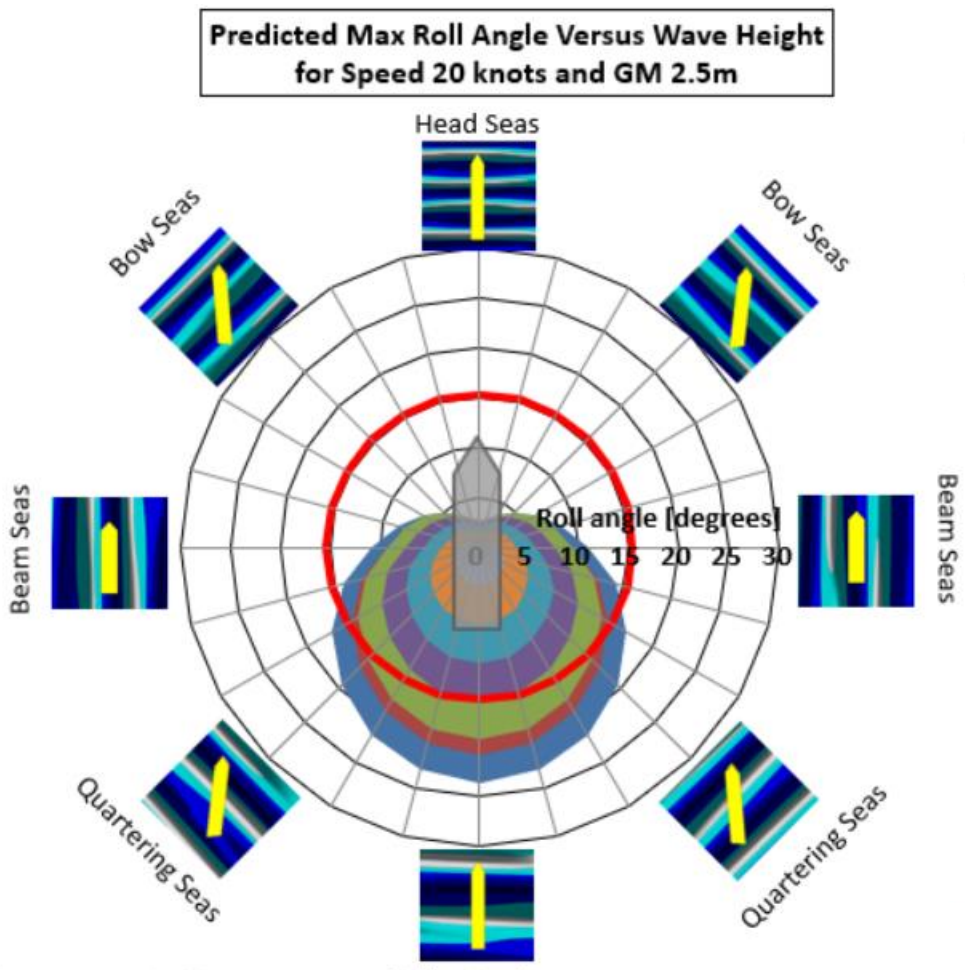

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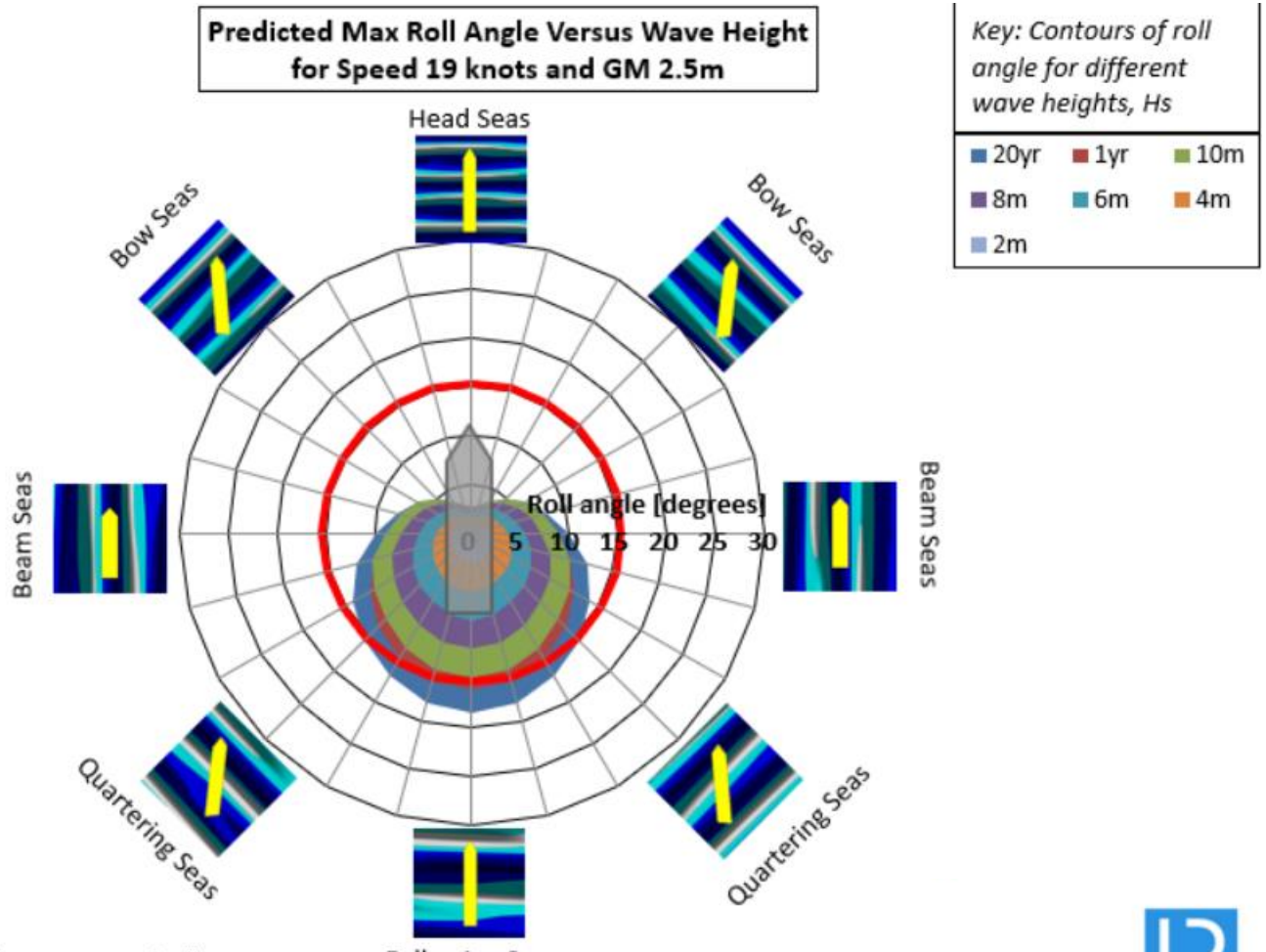


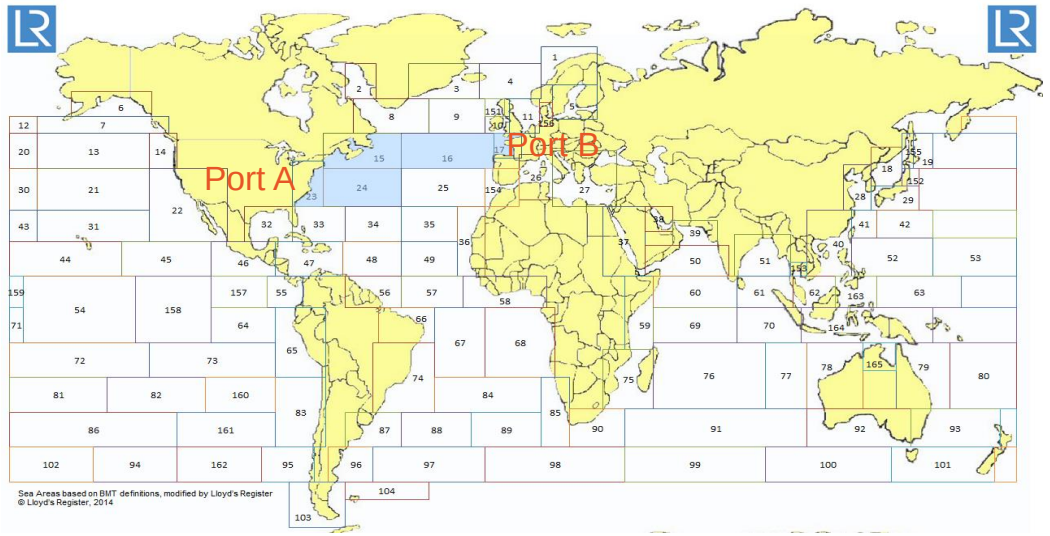
Chart shows expected roll in increasingly rough seaways

Class Options

Route/Weather Specific Operations

- Roll, heave, pitch and wind
- Transverse accelerations

- Increase flexibility
- Increase complexity



- Container Securing Software

Key Message

- Your classification society is here to help. Any issues or concerns – please ask. (BoxMax@lr.org)

- Container Securing Software is there to help. Take time to understand how to use it. Use it.

- Know your limits.

Best Practices of Cargo Securing Model

Igor Protsenko - Senior Software Engineer, Navis

Cargo Securing Model

Ship Motion Model

- Vessel
- Vessel floating condition (GM, KG, Draft)
- Environmental condition:
  Route/Season
  Current Weather
  Maximal Roll Angle
- Anti–rolling tanks

Cargo

Lashing patterns

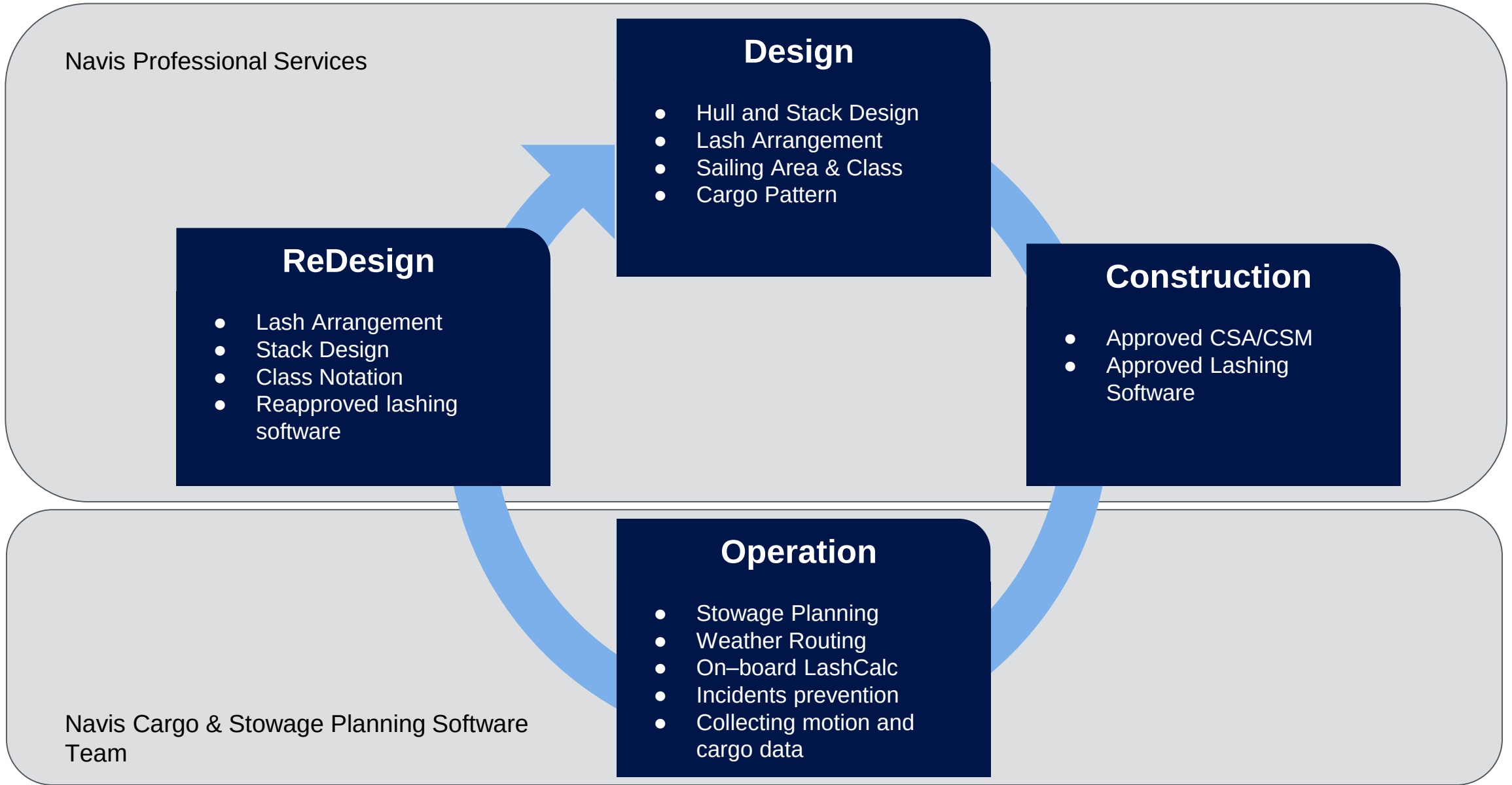
Lashing Computer Algorithms

(Cargo Securing Rule Set)

Lash forces evaluation

- Vessel strength
- Cargo strength
- Lashing material strength

A Vessel's Life Cycle & Securing Cargo



Best Practices with Navis Smart Solutions

Preventive Measures in Operations

- Approved Lashing Computer

MACS3 Loading Computer

- Efficient & Safe Planning

StowMan for shipping lines and Lashing API for terminals

- Well–Trained Users

MACS3 e–learning + StowMAN trainings

- Collaboration & Transparency

LashingApp & MACS3 Connected/Bluetracker; common model settings

- Gain Big Data Over Time

BlueTracker + MACS3 Connected

Navis Smart Solutions

Terminal

- Lashing App
- MACS3 Lashing API

Charterer / Liner

- StowMan

Owner/ Manager

- MACS3 Connected
- MACS3 Office version
- BlueTracker

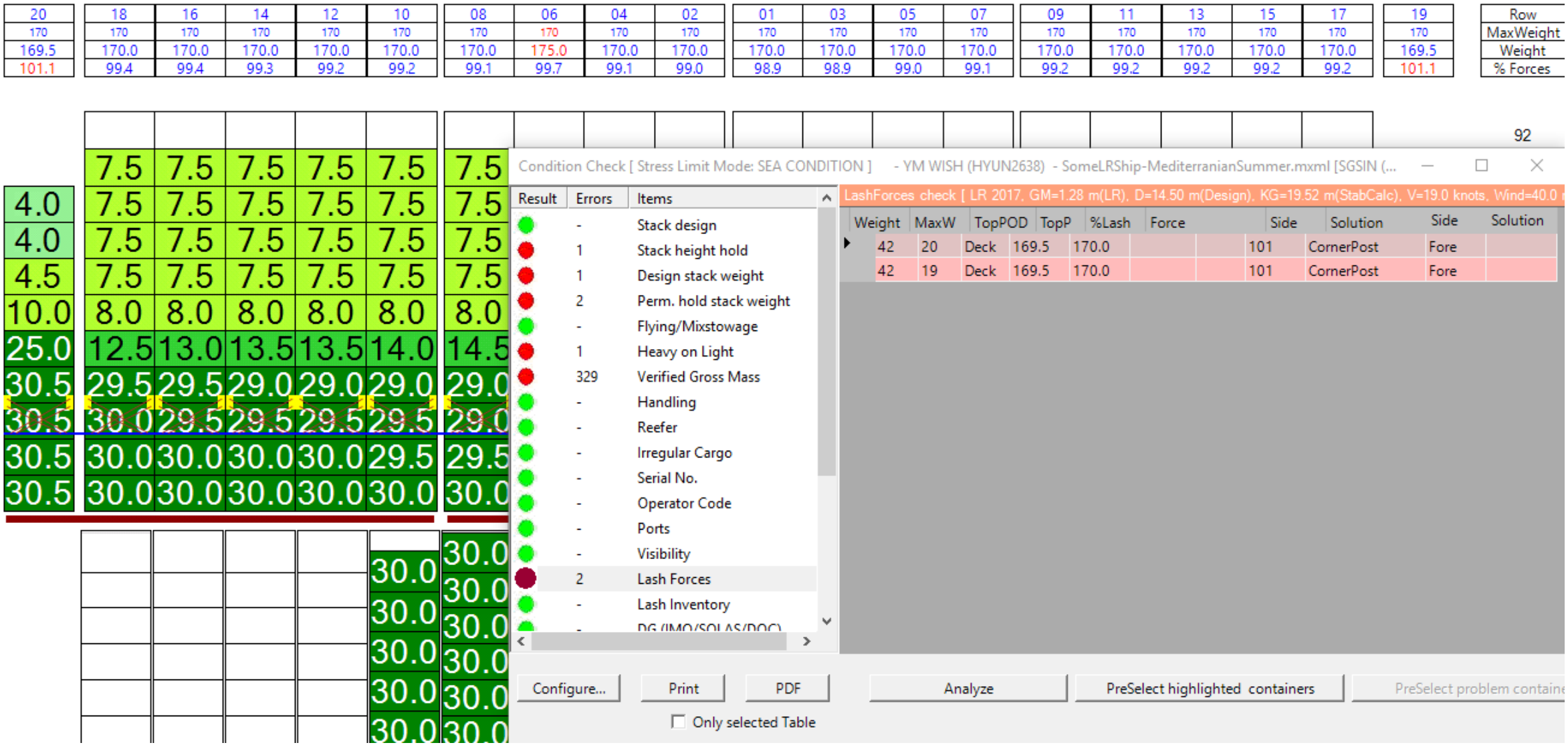
Vessel

- MACS3 Loading Computer
- Lashing App
- BlueTracker

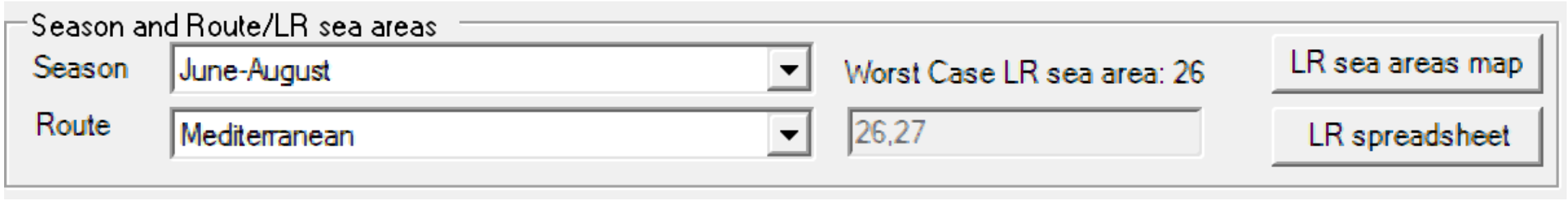
MACS3, StowMan, MACS3 API Checked Items

- Feasibility of lashing arrangement for given stowage
- Forces in containers (racking, lifting, corner posts) on deck and in hold
- Forces in lashing equipment (tensions in lashing bars or twistlocks)
- Forces acting on vessels structure (fundament, hatch covers, tank tops, cell guides)
- Lashing inventory (not enough lashing material)
- Accessibility of lashings in 20’ gap side, blocked by 40’ containers in discharge port
- Hatch cover clearance

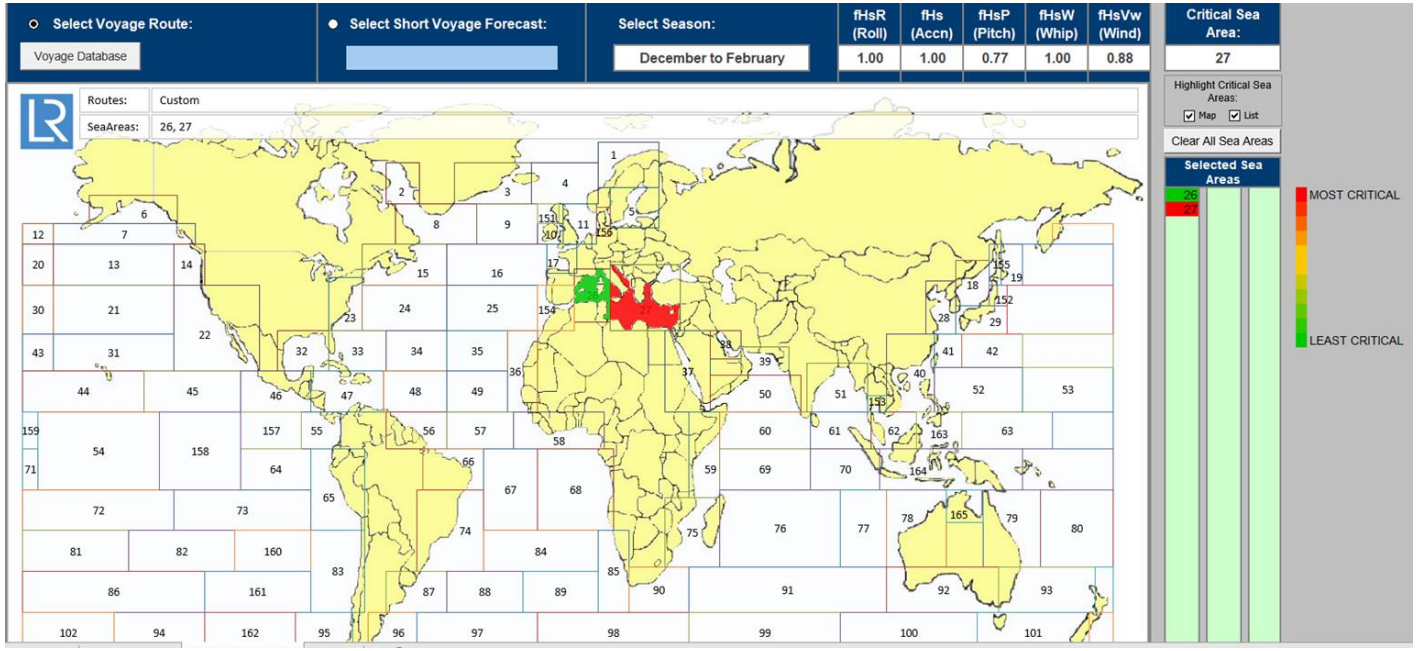
MACS3 & StowMan Checks



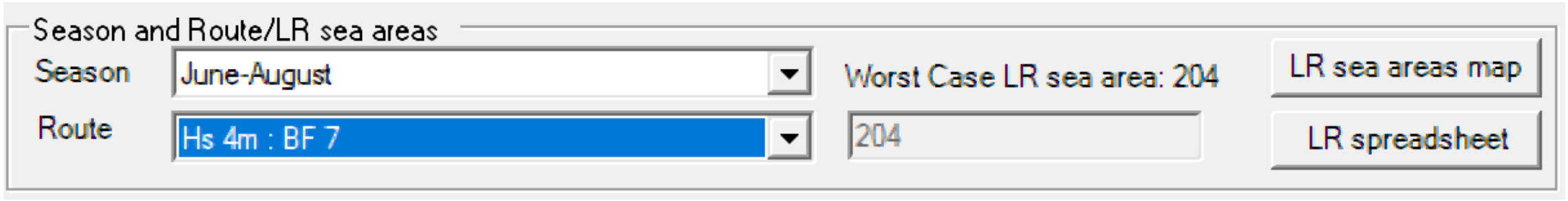
Long Haul Route-Specific (LR)



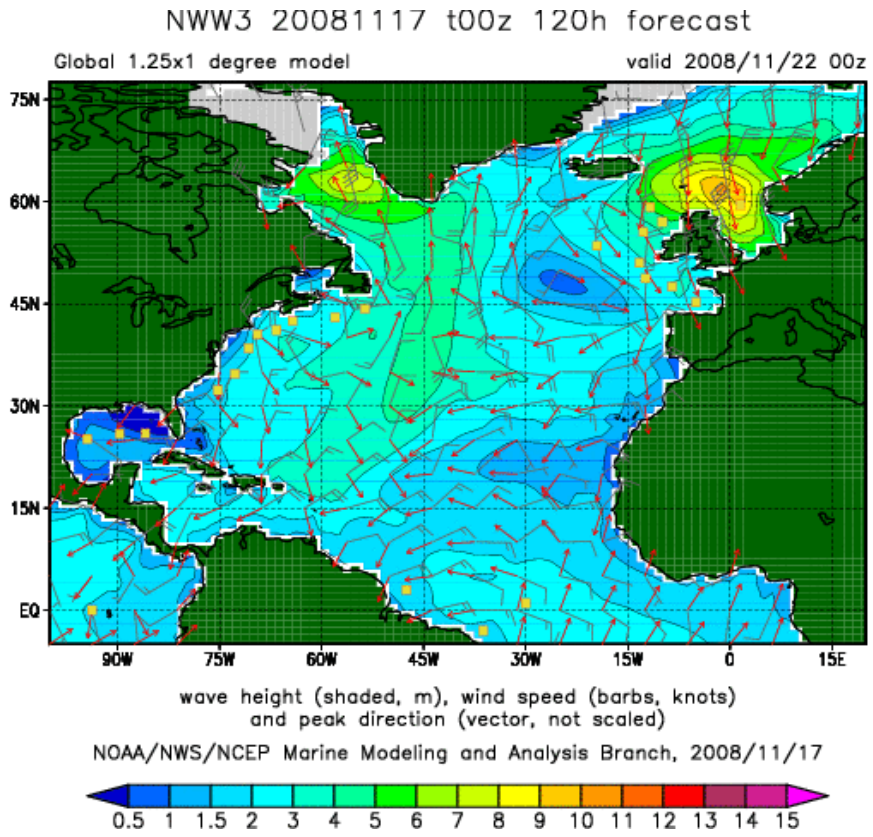
- Predefined Fixed Route
  (Static List of Sea Areas)
- Custom Route
  (Dynamic List of Sea Areas from LR Excel)



Short Voyage Weather-Specific (LR, DNV, ABS)



- Based on maximal significant wave height from weather forecast
- Valid for short voyages with max duration of 72 hours



Navis Smart Lashing App in Terminal Operations

Vessel Planner

Planner receives from Lashing App the incoming lashing patterns before discharge. Planner can override the lashing patterns from MACS3 for containers to be load

Stevedor

Stevedore receives and confirms (former on–paper) instructions for (un)lashing in real–time within the App

Captain

Captain receives notification on completion of lashing, upon check by the vessel crew approves the lashing and gives his feedback

1 2 3 7

navis nc+VS

4

Single Captain's identity across all terminals using Lashing App connection to Navis Identity Service

navis

Navis Smart Lashing App

5

navis N4

6

Lashing App derives lashing information using Navis N4 TOS interface to MACS3 Lashing API

MACS3 CONNECTED

Key Takeaways

- Use approved lashing computer software for modelling across all stakeholders
- Gain collaborative work–flow
- Be transparent: agree & share your modelling settings & calculation results
- Keep your crew trained
- Use route & season planning for long hauls
- Use weather–based planning for short voyages

Contact us for your tailor–made solution

Igor PROTSENKO
Igor.PROTSENKO@navis.com

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THANK YOU!

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Appendix A

Core values of cargo securing modelling

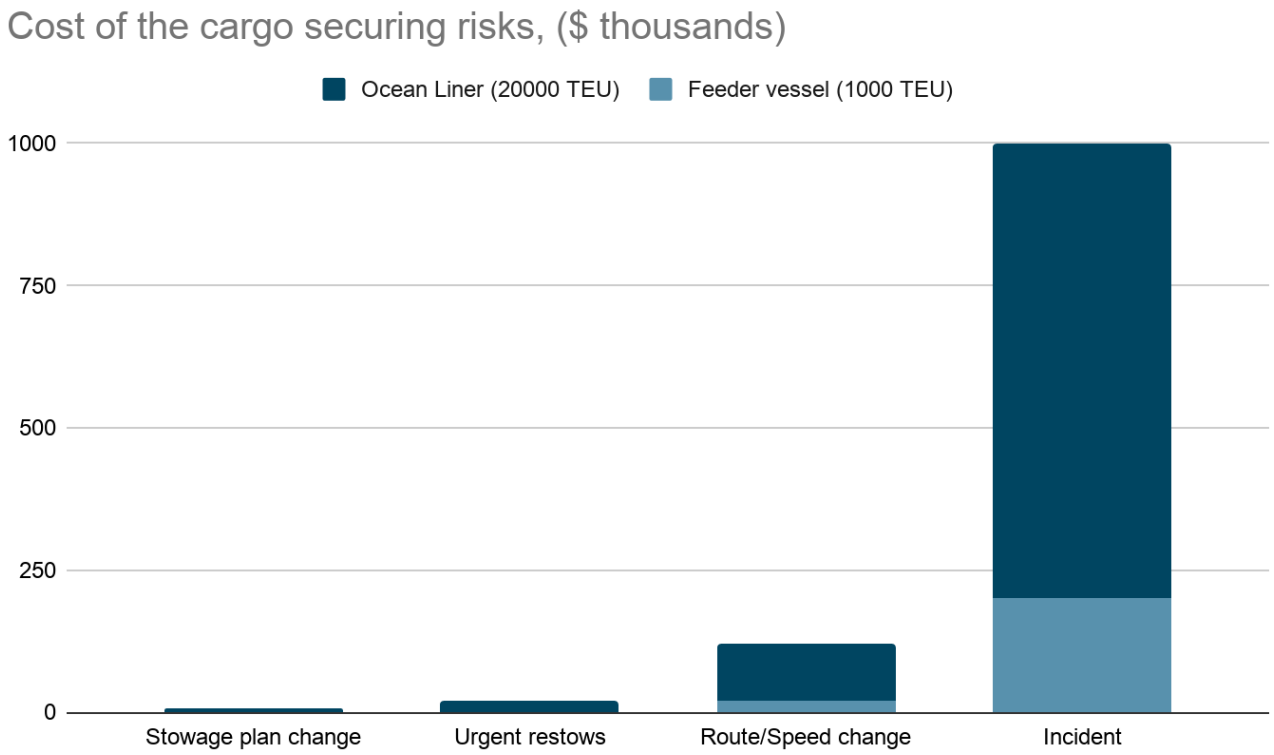
The Core Values of Cargo Securing Model

Safety for cargo, vessel and crew due to class-approved model

Visibility of future vessel and cargo conditions (what-if)

Transparency of loading conditions and evaluation results for all stakeholders

Flexibility in loading cargo under heavy environmental conditions



Core values

Cargo & vessel safety

Challenges

- Unexpected heavy weather conditions
- Unapproved lashing computer
- Wrong or lack of lashing equipment
- Inadequate stowage planning
- Invalid loading conditions
- Human incompetence

Navis solution

- What-if modelling
- Approved lashing computer (MACS3)
- Lashing process monitoring tool (Lashing App)
- Stowage planning with integrated lashing check (StowMan)
- Integrated loading condition validity check (MACS3, StowMan, API)
- Crew and planners training (on-site as well as e-Learning)
- Shore experts can support vessel crew (MACS3 connected, Bluetracker)

Core values

Visibility of future vessel and cargo conditions

Challenges

- It is difficult to predict the vessel loading condition in future ports
- Uncertain load list and terminal stowage plan corrections
- Uncertain weather condition during the voyage

Navis solution

- Stowage planning tool, enabling easy modification of cargo in each port call and on-the-fly lashing calculations (StowMan for shipping lines)
- On-board lashing computer MACS3 verifies suggested stowage plan in seconds
- Tool that enables terminals to verify their stowage plan (Lashing API)
- Use weather-forecast based short voyage mode, when possible

Core values

Transparency of loading condition and evaluation results among all stakeholders

Challenges

- Lack of information exchange between shipping line, vessel crew, terminal, owner or ship management team on shore
- Ignorance of cargo securing problems by terminal planners
- Pressure from shipping lines on cargo officers

Navis solution

- Using modelling and the same model on all planning steps: by shipping line, by terminal, by cargo officer on-board, by port state control
- Using both proprietary and UN/EDIFACT cargo and stability message formats to reflect the model properties as precise as possible
- Using approved lashing model and same settings enables to avoid invalid plans on early stages

Core values

Flexibility in loading the cargo

Challenges

- Unawareness of best planning practice
- Strictly sticking to the weight distribution in CSM
- Last minute changes in stowage plans
- Ignoring the possibility to use long-haul historical or short-time weather-forecast based vessel motion model

Navis solution

- Real-time lashing calculation during the planning ensure the safety of the stowage plan
- Heavy-on-light stowage, extra-heavy, extra-long or extra-wide containers are generally possible, assuming forces are not exceeded
- Changes in stowage plan are easy to validate by any stakeholder
- Unneeded restows during coastal voyage can be avoided by using weather-forecast-based short voyage mode

Appendix B

Navis MACS3 API Services in your Info Flow

Navis MACS3 API Services in your Info Flow

Your App (consulting tool, Terminal operating system, etc)

{ REQUEST }

{ RESPONSE}

MACS3 API SERVICES

CARGO

IMO: 1234567

Opt in for Navis Smart Suite which addresses your use case and incorporates the results:

- ✔ **Lashing API** for using class-approved cargo securing model
- ✔ **MACS3 Connected** for real-time access to the vessel loading condition
- ✔ **Ship Library** for accessing to your pool of vessel
- ✔ **Ship Viewer** for accessing the vessel properties

- ✔ Cargo
- ✔ IMO Number
- ✔ Calculation results

Navis Smart Solutions

NAVIS SMART SOLUTIONS
MACS3 Loading & Lashing Computer
StowMan Vessel Stowage Planning Software
Lashing Smart Application (iOS, Android)
MACS3 API (Lashing API)
MACS3 e-Learning

Contact us for your tailor-made solution

Igor PROTSENKO
Igor.protsenko@navis.com

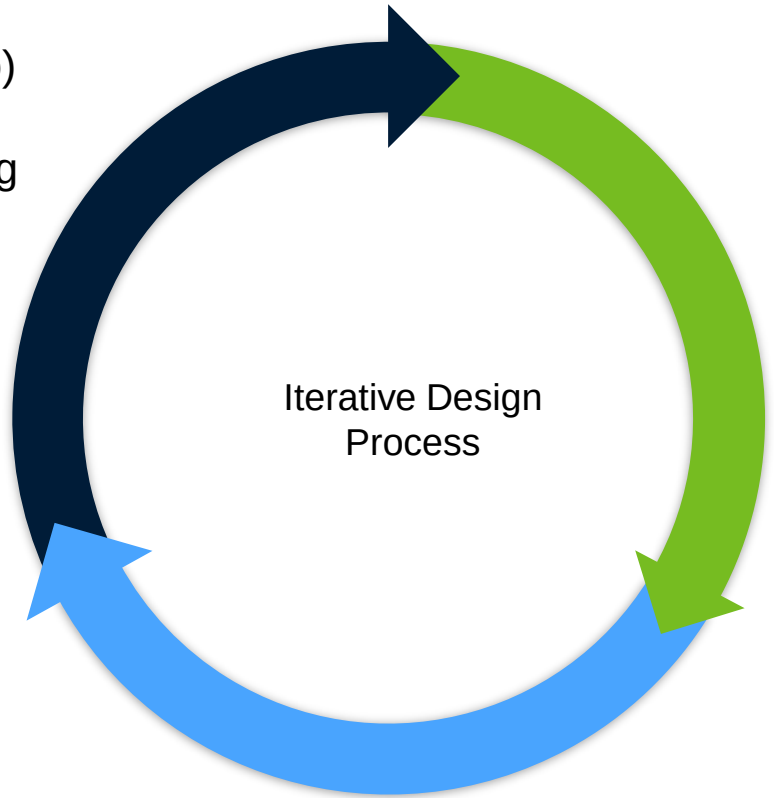
Appendix C

Best Practices of Cargo Securing Modelling in Ship Design

Best Practices of Cargo Securing Modelling in Ship Design

Owner

- define requirements
- define KPI (max. Cargo)
- know Cargo Pattern
- validate design (Lashing Calculation)



Design office

- design proposal to meet owner's requirements

Shipyard

- validate/ optimize/ complete design proposal
- create finalized vessel data set

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THANK YOU!

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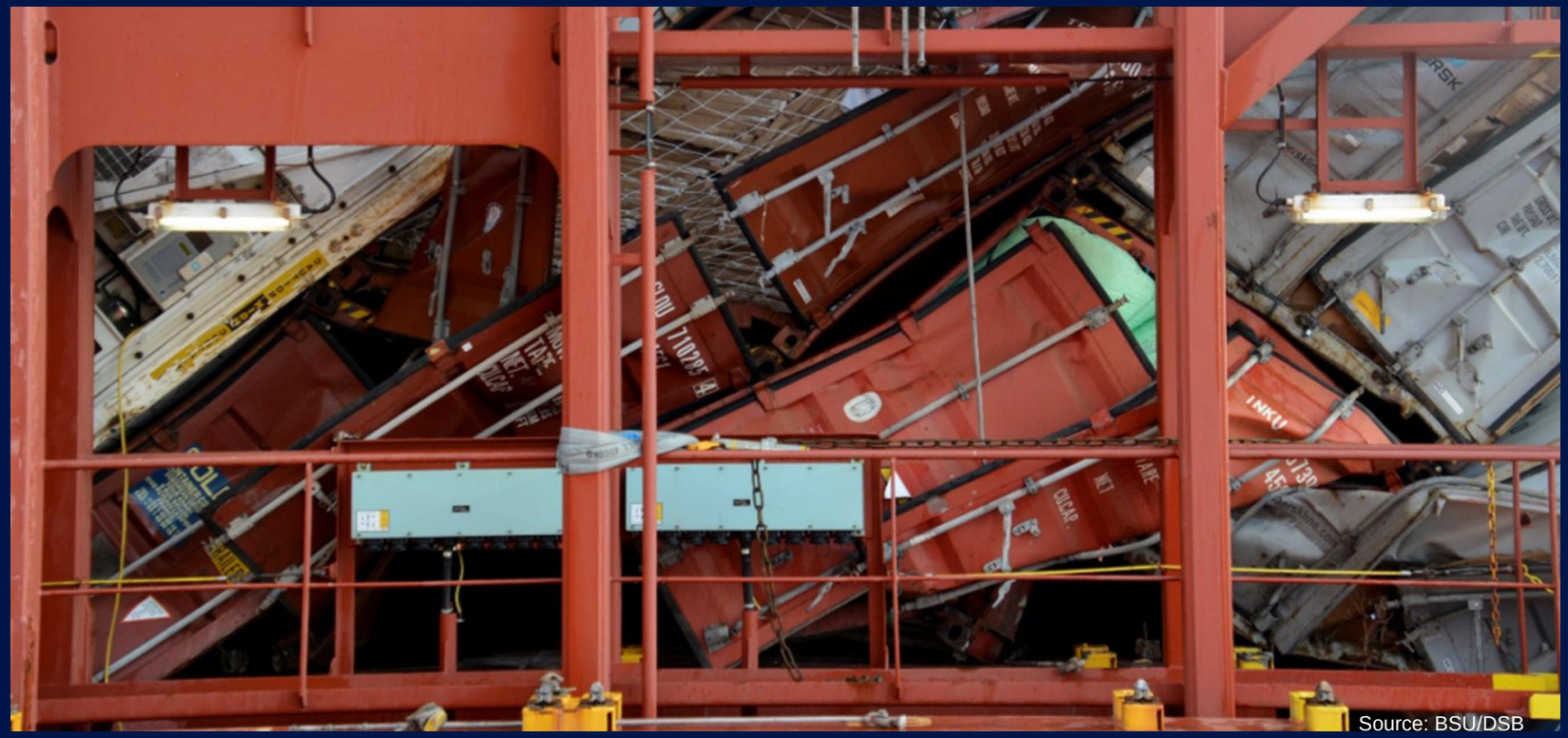
Questions?



Source: BSU/DSB

Questions

The Crew needs to rely on the Cargo Securing Manual (CSM) which is a Class approved document. How reliable is it? Do we need regulations for issuing a CSM?

Questions

Stowage planning software seems to be getting increasingly sophisticated. What are the next big developments, eg. AI, machine learning?

Questions

Can you explain the link between route specific Class notation and the original CSM if this notation is given to an existing ship? How do we convince PSC that we are fully compliant?

Questions

Due to the increase in numbers of containers lost at sea, the high number of containers stacked above deck and the importance of reliable securing arrangements, is it time to dispense with lashing bars which are unreliable due to the human element, and build in full height container guides?

Questions

Online Poll

Questions

A CSM has a design GM which is often less than the vessel's departure GM. How can a ship's master check the lashing stresses if lashing software is often not even approved by Class? Is the lashing software in compliance with SOLAS?

Questions

What is the most effective lashing bridge height?

Questions

How is the maximum allowable roll angle determined for Container Ships loaded to their capacity based on the usual stability limit?

Questions

It seems that there have been more incidents recently due to weather. Is this really a significant factor? Are there issues with weather routing?

Questions

Does the panel think that there is any correlation between the age, and by potential default, the condition of the containers, particularly those on the bottom of the outboard stack, having any bearing on the collapse of stacks?

Questions

In the majority of cases, the loss has been greater in the stern area. Why are designs with fuller sterns OR reductions in stack height & weight not being considered?

Questions

Some investigations of the last incidents showed that one of the reasons was the exceeding of allowed forces limits, especially for non-ISO containers with reducing stacking capabilities. What can be a solution for the lack of this data in the planning process?

Thank you

Source: BSU/Netherlands Coastguard

For more information: lossprevention@tindallriley.com

Website: www.britanniapandi.com

Twitter / Instagram: @britanniapandi

LinkedIn: www.linkedin.com/company/britannia–p–i–club

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