

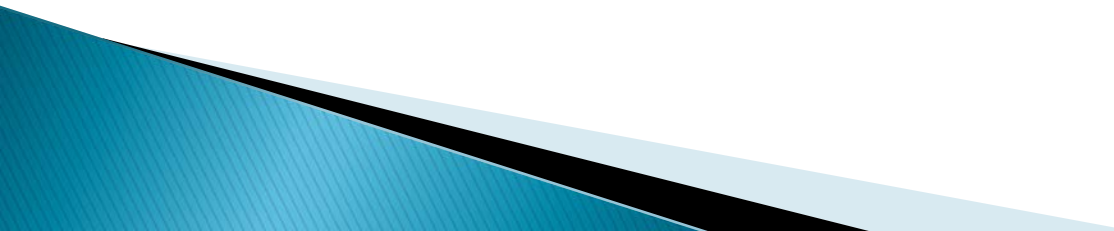
HANDLING SHIPS IN HEAVY WEATHER

Captain Balraj Nair,
a serving ship Master's perspective

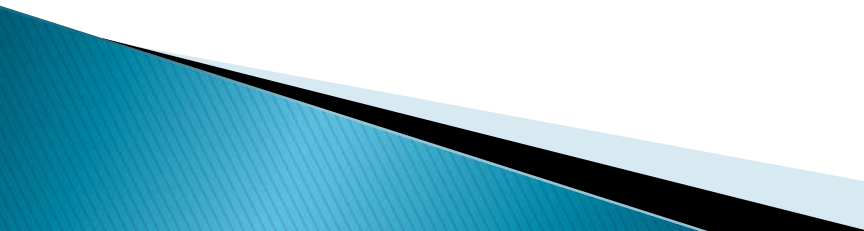
Fleet Management Limited, Hong Kong



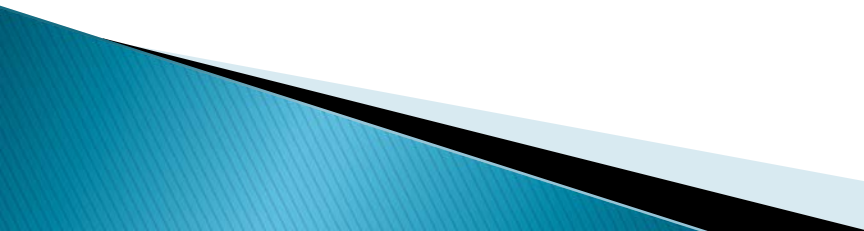
INTRODUCTION – FML

- ▶ Fleet Management Limited was established in year 1994
 - ▶ This is our 25th year in Ship Management Business
 - ▶ Presently 500+ ships under our Management, comprising various types of vessels– Oil, Chemical and Gas Tankers, Bulk Carriers, Containers, Car Carriers, etc
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FML –Awards

- ▶ Outstanding Performance Award in Port State Control Inspection for the year 2017, May 18
 - ▶ Tanker Shipping and Trade Awards, Lifetime Achievement Award 2017, November 17
 - ▶ International Bulk Journal Awards, Winner in 'The People Development' category, November 17
 - ▶ Lloyd's List Maritime Asia Awards, Winner in 'Lifetime Achievement Award' category, October 17
 - ▶ Green Environmental Achievement Award, Port of Long Beach, Green Flag Voluntary Vessel Speed Reduction Program in 2016, June 17
 - ▶ Marine Department Awards, Government of Hong Kong, Outstanding Performance Award in Port State Control Inspection for the year 2015, June 16
 - ▶ Lloyd's List Maritime Asia Awards, Winner in 'The Innovation Award – Systems, Business Process and Business Models' category, October 15
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OBJECTIVE

- ▶ **Ship handling in heavy weather**
 - Understanding the vessel
 - Understanding the Seas
 - Preparation, passage plan & Tracking
 - Handling the vessel
 - Post heavy weather checks
 - Conclusion
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ROUGH SEAS & SHIPS



ROUGH SEAS & SHIPS

- ▶ Heavy weather can be described as any condition of wind and waves which is likely to cause a vessel to undergo severe motion or responses thereby increasing probability of damage to personnel, cargo and ship than normal



UNDERSTANDING THE VESSEL

- ▶ **Stiff ships**—high GM, small angle & period of Roll, Eg: Bulkers, Ore carriers
 - Violent rolling and irregular rolling,
 - Severe stress on Hull and likelihood of general cargo breaking loose
 - Short violent movement can lead to moisture migration in ores and subsequent shift of cargo

UNDERSTANDING THE VESSEL

- ▶ Tender ships—Low GM, large angle and period of Roll

Eg: Container, Heavy lifts

- Possibility of vessel becoming unstable due to Negative GM during passage owing to consumption of fuel and fresh water

UNDERSTANDING THE VESSEL

- ▶ Period Of Roll : Time Taken for ship to Roll once completely, Viz, stbd to stbd. Can be visually observed using stop watch in calm weather, or obtained from stability booklets Or by formula

$$Pr \text{ (in seconds)} = 0.8BM / \text{Root of GMt}$$

- ▶ Period of Pitch: Time taken to complete one pitch cycle

$$Pp = 0.5 \times \text{Root of LBP}$$

UNDERSTANDING THE VESSEL

In containers with doubtful weight distribution, fluid GM can be confirmed by running known weights into the heel tanks and using the formula given below .

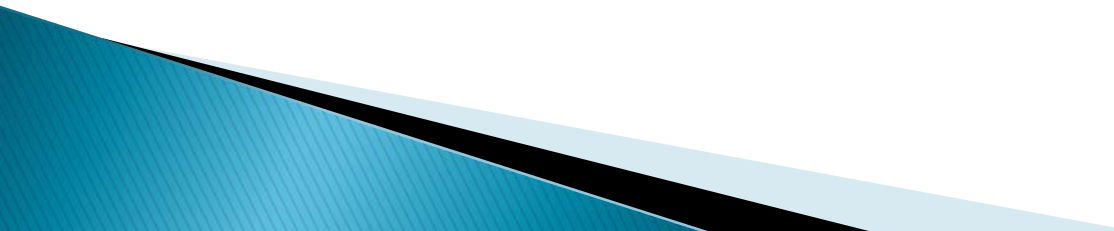
$$\text{Tan } \theta = \frac{dw}{W.GM}$$

where,

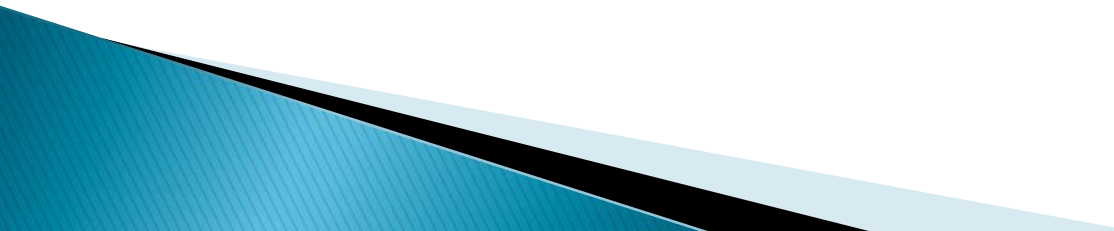
- ▶ θ – angle of heel observed
- ▶ d – distance between CoG of tanks
- ▶ w – weight of ballast transferred
- ▶ W – displacement

PLANNING THE PASSAGE

As per good Doctors' advice –
'Prevention is the best cure'

- ▶ Trading vessel cannot avoid planning the optimum route through areas of established disrepute for rough seas, though alternatives have been considered
 - ▶ However thorough study of the sea conditions expected, action to be taken and contingency planning are to be studied.
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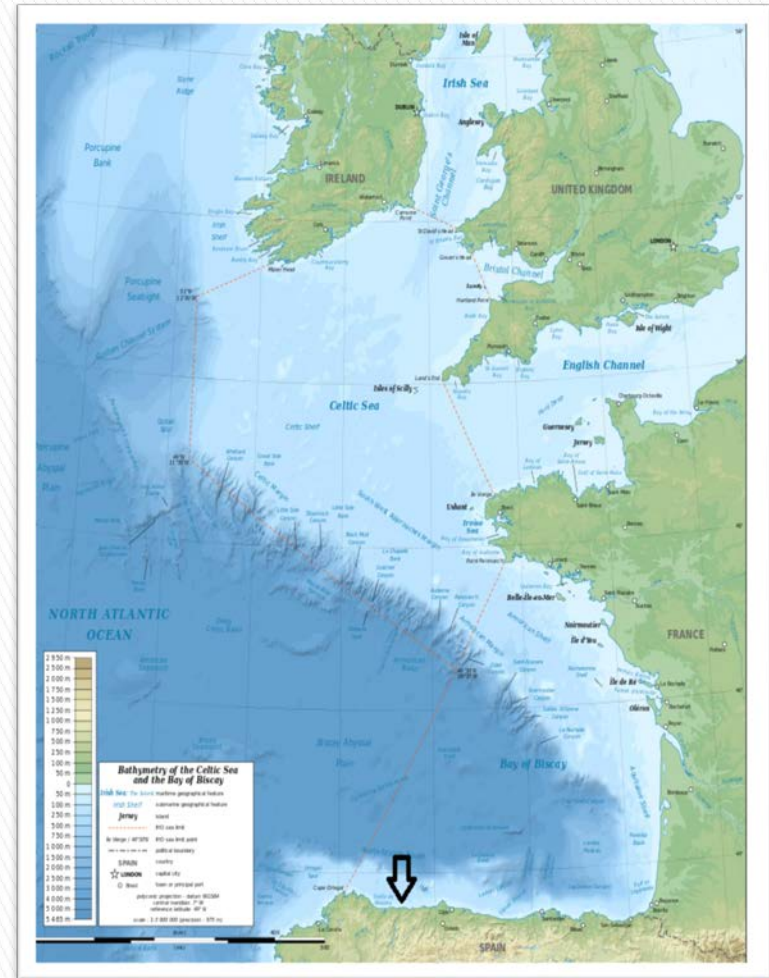
IMPORTANCE OF SHELTERS

- ▶ Heavy weather of vessel in coastal water and archipelago water are more demanding and critical
 - ▶ Holding on to safe heading and speed to dampen the seaway movements may lead vessel towards unsafe direction of any navigation hazards
 - ▶ Identification of sheltering coves and bays is crucial
- 

STUDY OF TAKING SHELTER

On a Voyage from Sweden to Egypt carrying on deck packaged timber

- ▶ On clearing English Channel, vessel faced storms approaching from south and west
- ▶ Vessel had to take shelter at Gulf of Masma of Cape Ortegal



HEAVY WEATHER PREPARATIONS


▶ TIGHT SECURING

- ▶ Anchor double lashed, bow stopper in place, spurling pipes cemented
- ▶ Checking, double checking of Cargo Lashing, Holds battening buckles, Booby hatches
- ▶ Ventilation – suspended during heavy weather and ventilators to be battened down to avoid water ingress
- ▶ Load Line life lines to be rigged on main deck and ensured tautness
- ▶ Ensure weather tightness of Focsle lockers, Focsle store to be electrically isolated
- ▶ Absolute securing of all moving parts of cranes, derricks and booms


HEAVY WEATHER PREPARATIONS

- ▶ Ensuring no loose objects in Main deck and accommodation decks (Daily use tools, paint drums, lub oil drums)
- ▶ Double check on life boat lashing, life raft securing, though to ensure that they can be easily launched
- ▶ Ensuring maximum propeller immersion
- ▶ Managing of GM by ballasting, de-ballasting tanks
Transferring fuel to arrive at optimum FSE
- ▶ Reduction of speed, to maintain Engine/Propeller/shaft load within safe parameters
- ▶ Enhanced Steering power

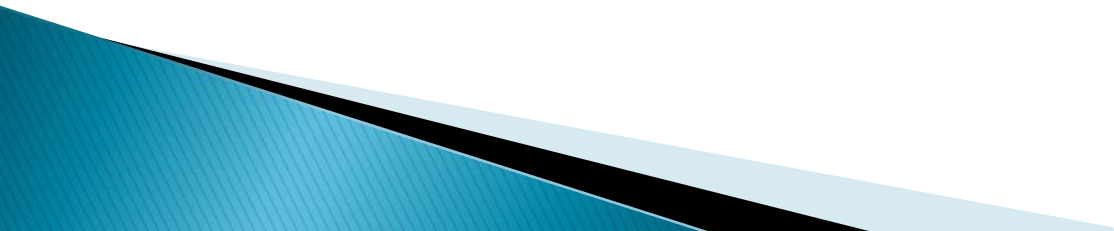
ENGINE ROOM & MACHINERY

- ▶ Engine Over speeding issues; governor and load setting to be changed for heavy weather.
 - ▶ Stern tube oil loss; check levels.
 - ▶ Tanks could overflow during sloshing; conversely low levels could loose suction, check levels.
 - ▶ Steering gear under load; check for oil losses from seals, lubrication of motors, tightness of foundation bolts.
 - ▶ Load and black out chances increased, run extra AE, monitor load sharing etc.
 - ▶ Loose gear, gantry hooks etc to be well secured.
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ENGINE ROOM & MACHINERY

- ▶ Lower sea suction to be used.
 - ▶ Check sounding pipes, vent heads on deck in advance. Higher probability of seawater ingress into tanks.
 - ▶ Filters may get clogged quicker.
 - ▶ Elevator to be stopped and secured.
 - ▶ Turbo charging surging may be experienced. Higher exhaust temperature. Aux. scavenge blowers may need to be run on manual.
 - ▶ Watertight doors and other openings to be secured to prevent ingress of seawater.
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TRACKING THE WEATHER

- ▶ Global warming and climate changes is seriously challenging the existent weather prediction modules and traditional tracking methods.
 - ▶ Buys Ballot's law, Barometric tendency, though remain your basic tools is insufficient to meet the fast pace of modern shipping and constantly changing and erratic isobaric patterns.
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TRACKING THE WEATHER

Weather charts.

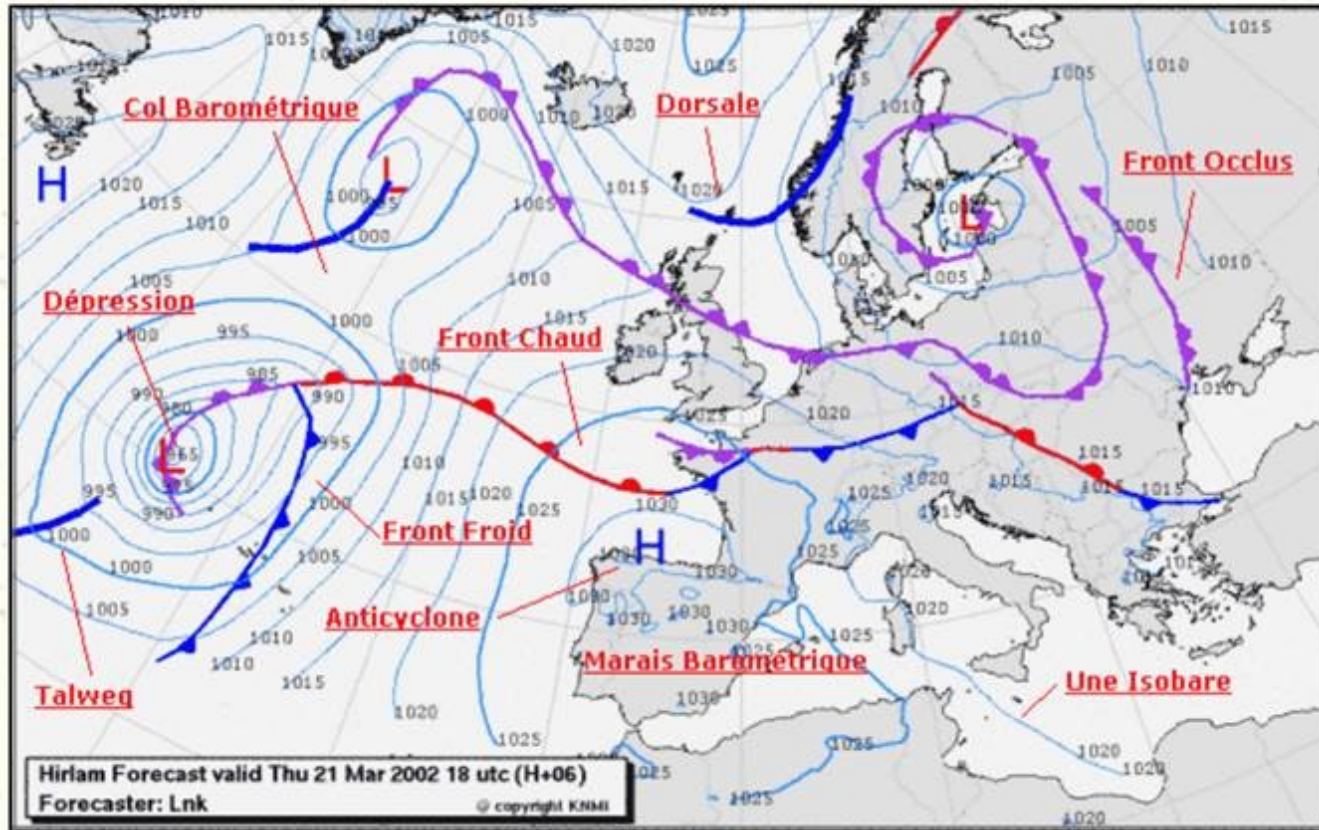
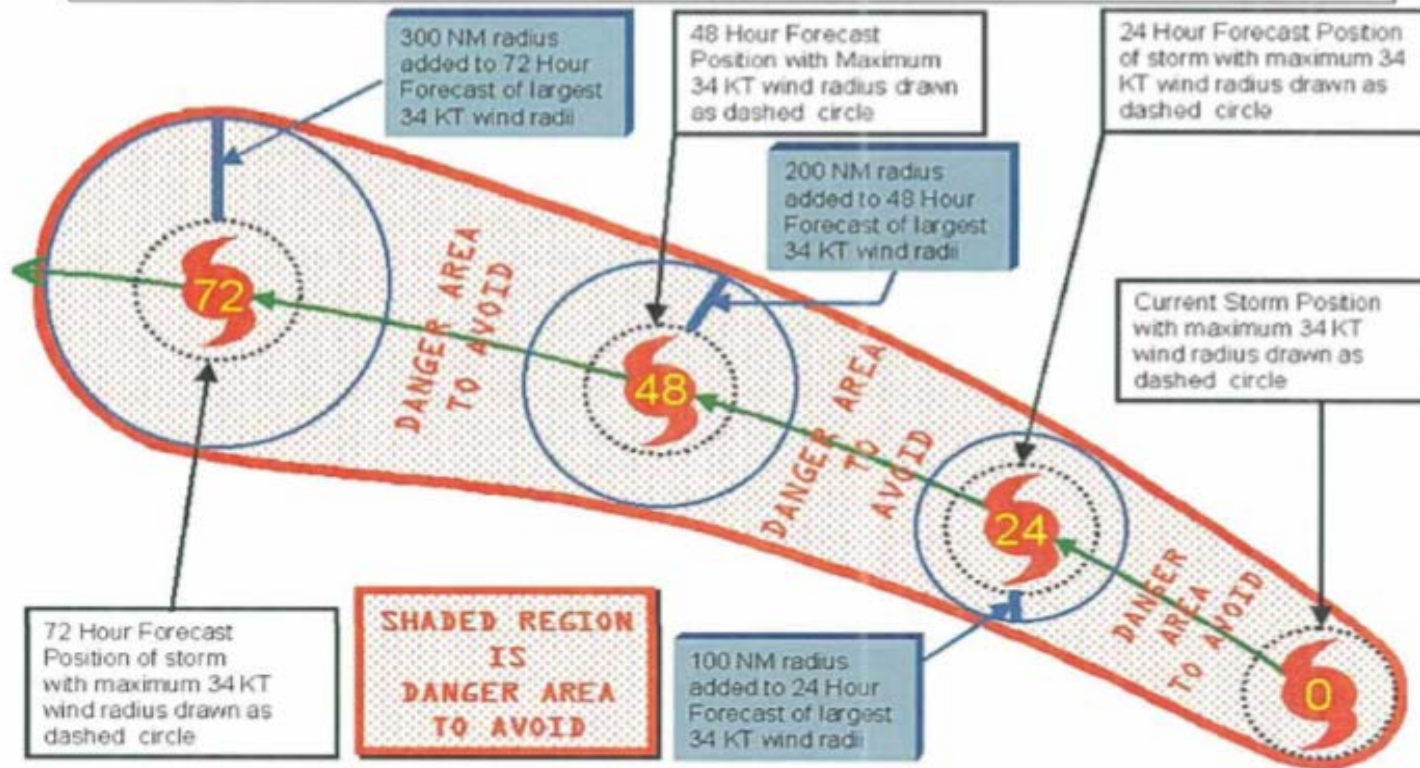


Diagram of the 1-2-3 Rule

The danger area to avoid is the area inscribed by the connecting tangent lines of the outer most radius of 34 knot winds plus a safety margin derived from the ten year average Atlantic tropical cyclone position errors at the 24, 48, and 72 hour forecast positions. Adding 100 NM at 24 hour forecast, 200 NM at 48 our forecast, and 300 NM at the 72 hour forecast positions.



Fast paced net & modern communication including weather routing, company monitored weather tracking & routing tools are of immense help. Even your wife at times can send you weather attachments.

TRACKING THE WEATHER

123 Rule

- ▶ Predictions on EGC, Navtex and weather fax are not exact science and as a thumb rule maintaining
 - 100 NM distance from 34 knots wind circle of predicted 24 hour storm centre
 - 200 NM distance from 34 knots wind circle of predicted 48 hours storm centre
 - 300 NM distance from 34 knots wind circle of predicted 72 hours storm centre

UNDERSTANDING THE SEAS

- ▶ Wave Period: Time required for two successive wave crests to pass a fixed point

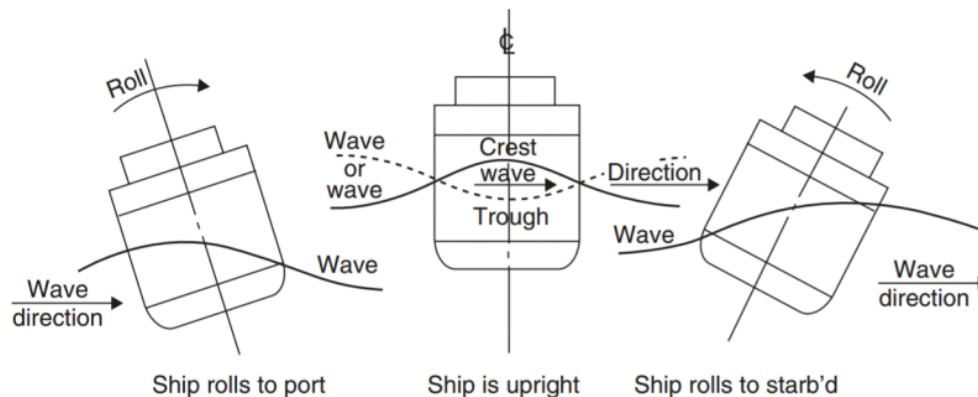
- ▶ Wave Length: Distance between two successive wave crests

$$\lambda = 1.56 \cdot T_W^2 \text{ [m]} \text{ or } T_W = 0.8\sqrt{\lambda} \text{ [s]}$$

- ▶ Period Of Encounter: Time between hull meet two successive waves.

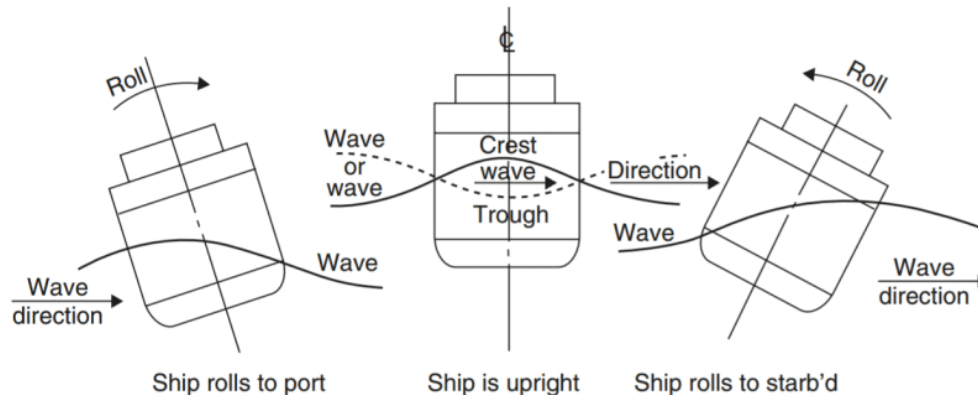
$$T_E = \frac{3T_W^2}{3T_W + V\cos(\alpha)} \text{ [s]}$$

SYNCHRONOUS ROLLING



- Abeam and Quarter Waves.
- PERIOD OF WAVE is equal to PERIOD OF ENCOUNTER
- Amplitude of Roll increases, to high values

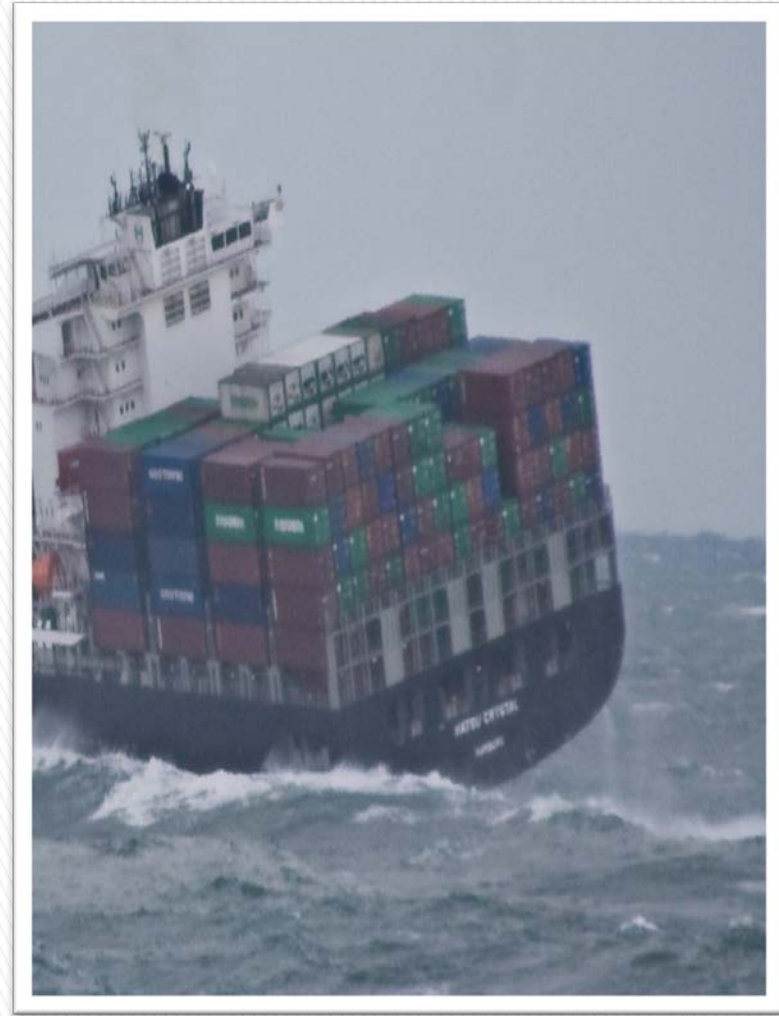
SYNCHRONOUS ROLLING



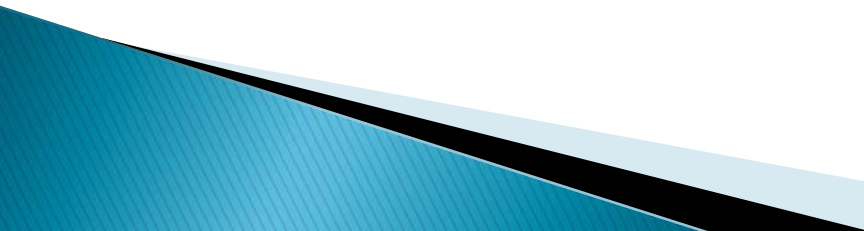
Preventive action: Alter course when period of encounter of Beam and quartering seas is equal to natural roll period of the vessel

PARAMETRIC ROLLING

- ▶ Ships with wide beam, stream lined underwater hulls at the bow and large bow flares are prone to parametric rolling
- ▶ During moderate pitching, ship has rolled slightly to one side, sudden immersion of the large flare causes the restoring buoyancy force to push the bow upwards and to the other side of the roll.
- ▶ The opposite happens during the next pitch of the bow downwards.



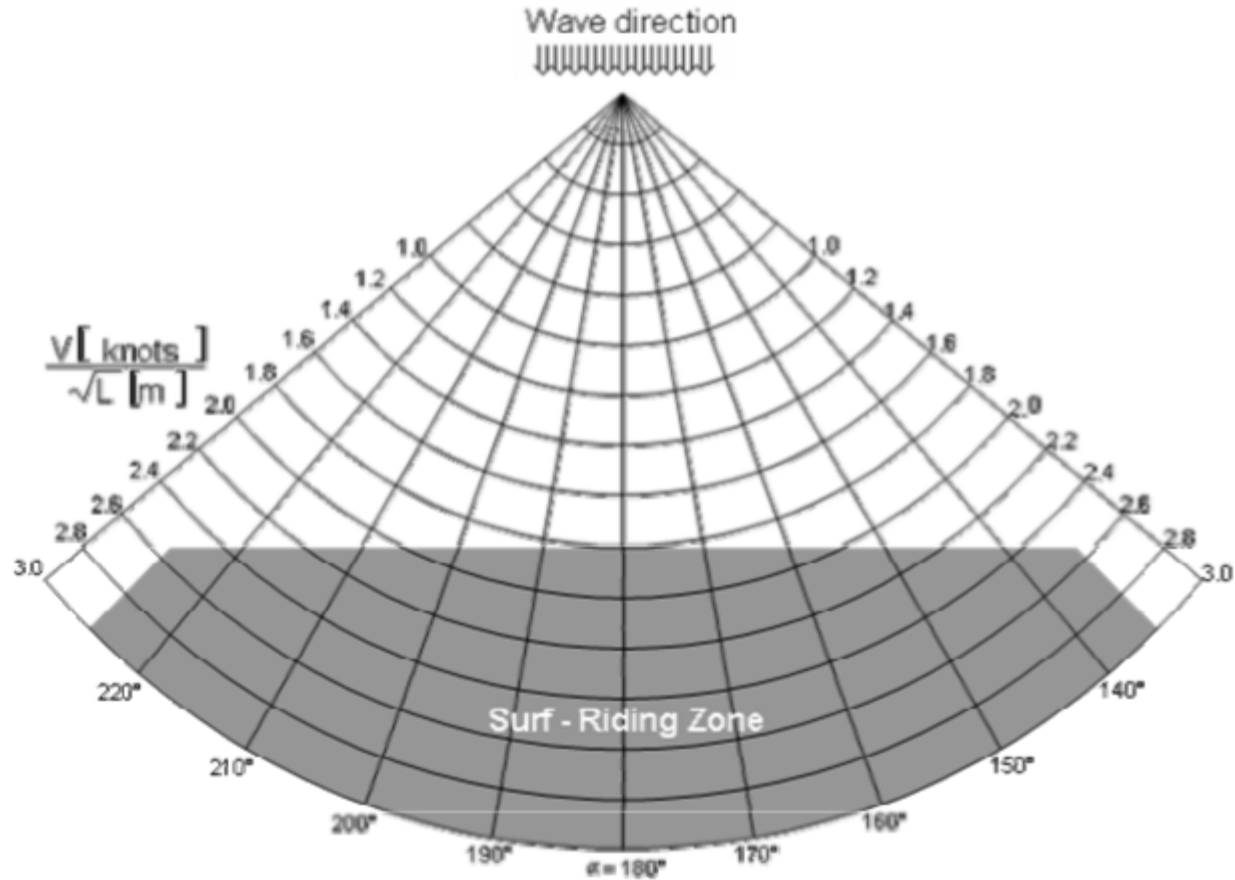
PARAMETRIC ROLLING

- ▶ Occurs when pitching is heavy enough for flared bow to submerge when pitching ahead. HIGH AMPLITUDE WAVES during ahead and following seas
 - ▶ PERIOD OF ROLL is equal to or twice the PERIOD OF PITCH
 - ▶ **Preventive action:** Alter course to break the synchronism, if time and space permit steer a zig-zag course till conditions improve
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SURF RIDING & BROACHING

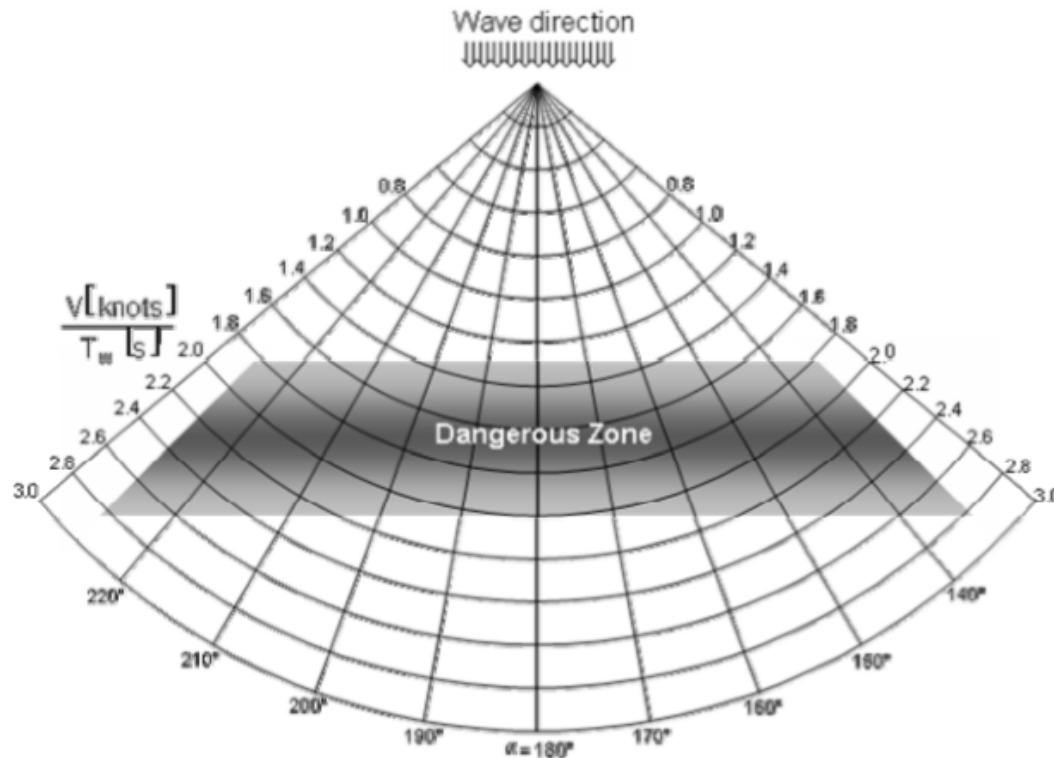
- ▶ When the ship is accelerated to ride on the wave of quartering seas or following seas, the intact stability can be decreased substantially according to the changes of the submerged form
- ▶ The stability reduction may become critical for wave lengths within range of $0.6L$ to $2.3 L$ leading to capsizing of vessel.

SURF RIDING & BROACHING



Risk of surf-riding in following or quartering seas


SUCCESSIVE HIGH-WAVE ATTACK



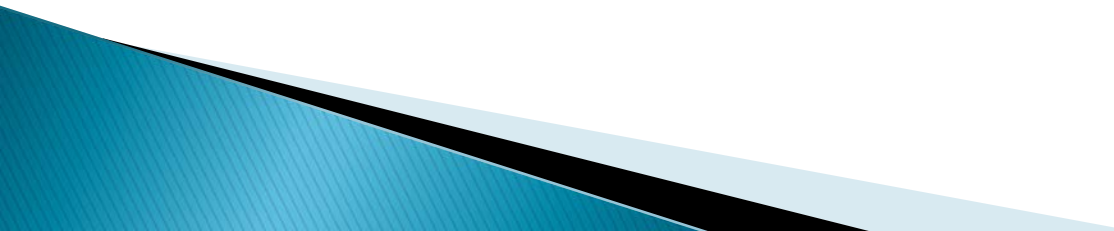
Risk of successive high wave attack in following and quartering seas

Broadly speaking when the wave length is larger than $0.8L$ and the significant wave height is larger than $0.04L$, avoid entering in to the dangerous zone by reduction of speed or alteration of course

TURNING A VESSEL IN HEAVY WEATHER

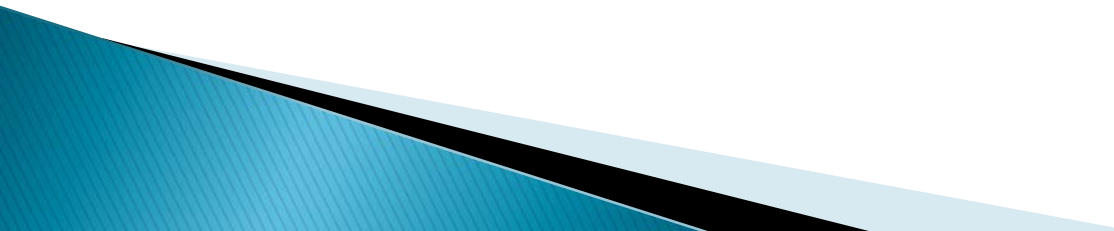
- ▶ Requires careful observation of the sea condition and accuracy of judgment
 - ▶ There is always a stretch of moderating sea in the wave development cycle
 - ▶ Turn commencement should start at the end of heavy seas cycle and should be completed before the moderating stretch is over. Use of full helm and engines power as available is to be used
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POST ROUGH WEATHER CHECKS

- ▶ All Round Sounding
 - ▶ Check vulnerable areas of structural damages
 - ▶ Lashing checks
 - ▶ Cargo condition checks
 - ▶ Check ME performance at first available opportunity.
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CONCLUSION

Key to successful execution of Marine Adventure

- ▶ Proper planning
 - ▶ Preparation
 - ▶ Understanding vessel's characteristics
 - ▶ Meeting rough weather with astute and careful reading of the vessel/weather inter-dynamics
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*Last but not least prayers and a bottle of water
for strained nerves helps*

