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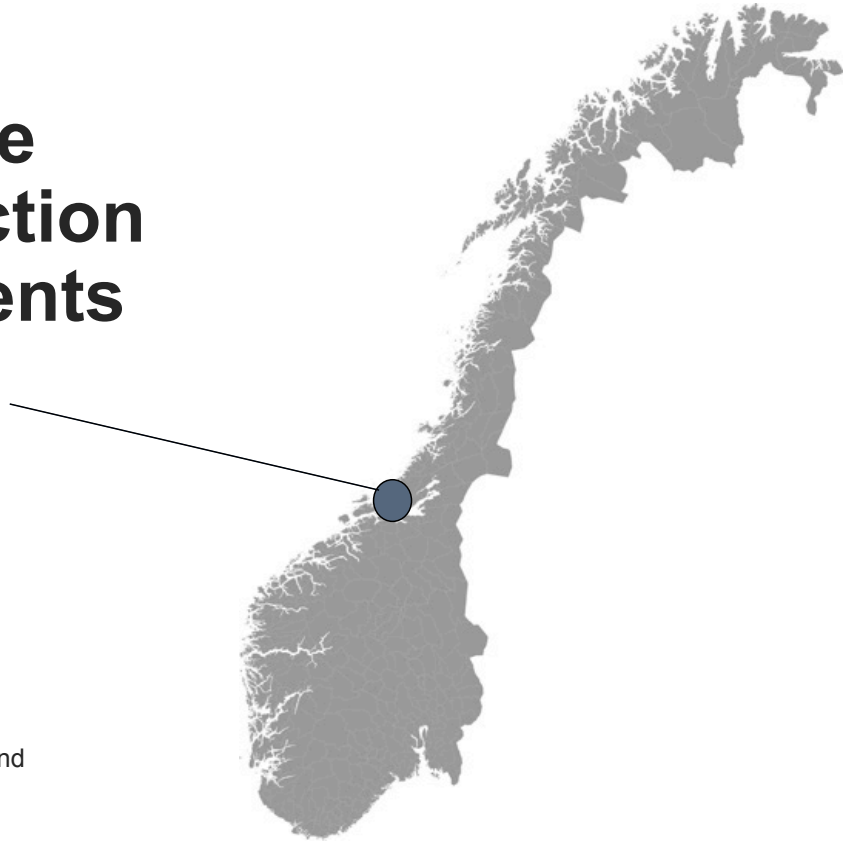
Case study of major accident to demonstrate the possibility of prediction of conditions for accidents

#48



Presenter:
Tiantian Zhu

Authors:
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[a] Department of Marine Technology, Norwegian University of Science and Technology, Trondheim, Norway

[b] Department of Mechanical and Industrial Engineering, Norwegian University of Science and Technology, Trondheim, Norway

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Research path

Specify research interest

- Prediction of the conditions for accidents

Literature study

- Turner's man-made disaster theory for accident development
- Risk analysis (QRA and real-time risk monitoring)
- Previous studies about MV Sewol accident

Propose hypothesis

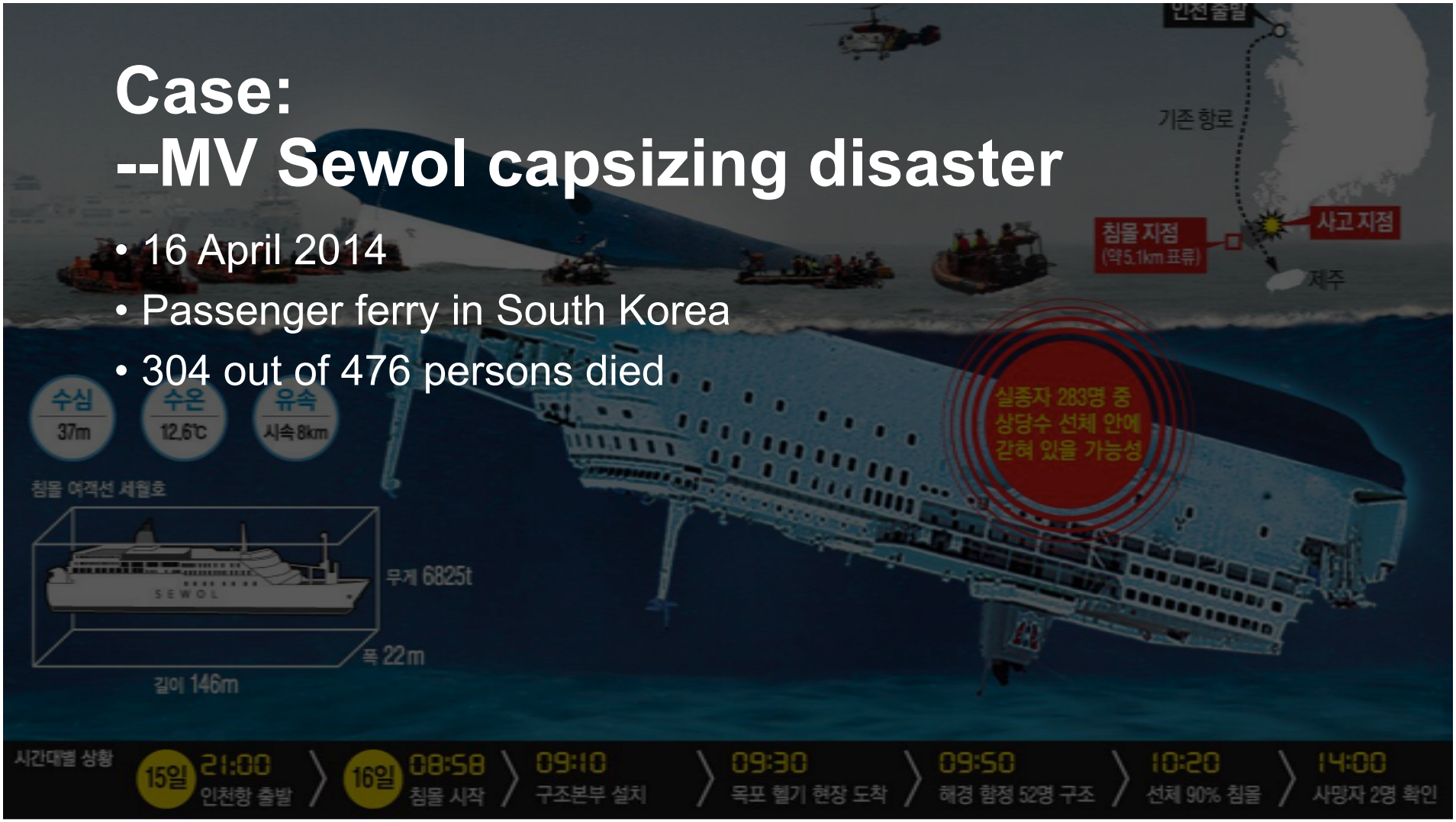
- Conditions of accident is possible to be anticipated if a capable accident model and data are available

Case study for verifying hypothesis

- Define system boundary
- Develop accident model
- Investigate the availability of information with time and information holders
- Intergrate the collected information and their time of being available to accident model to verify whether the accident can be predicted

Case:
--MV Sewol capsizing disaster

- 16 April 2014
- Passenger ferry in South Korea
- 304 out of 476 persons died



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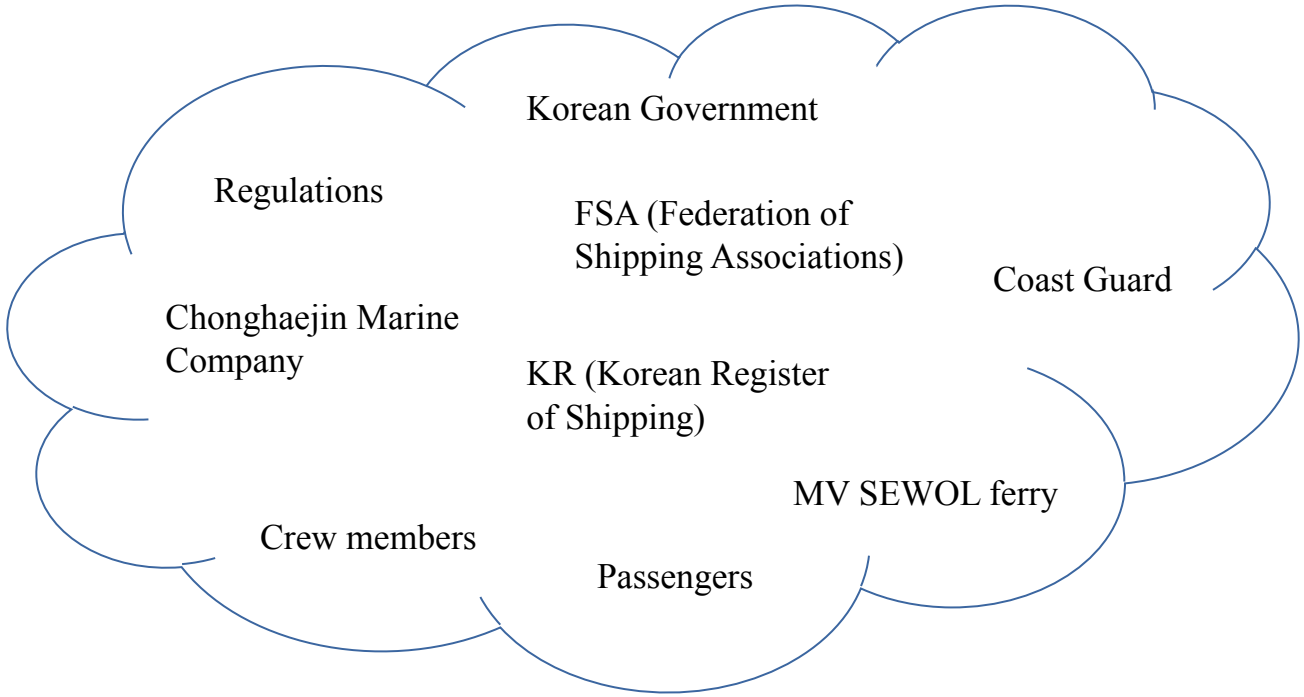
System components in MV Sewol capsizing



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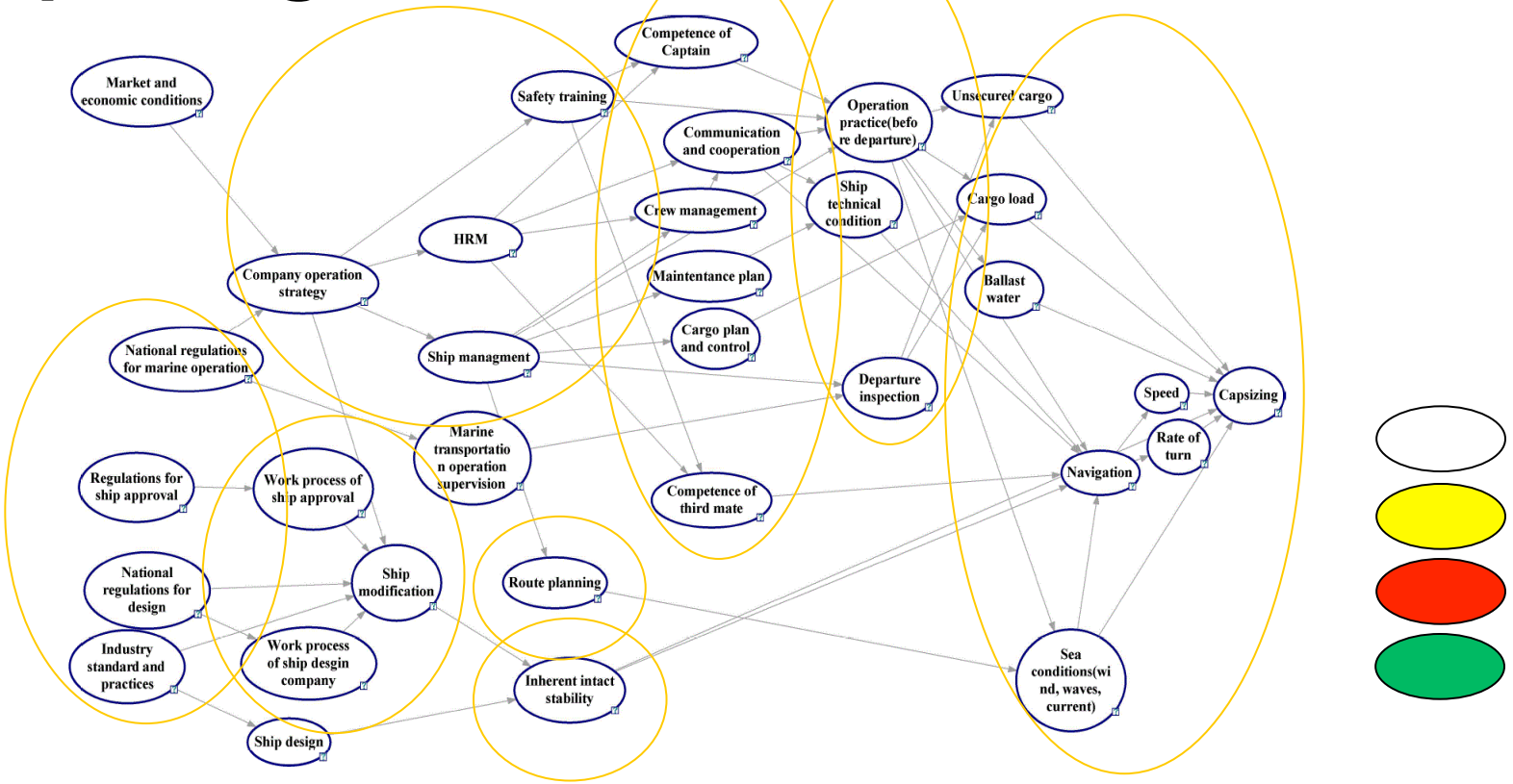
Capsizing accident model



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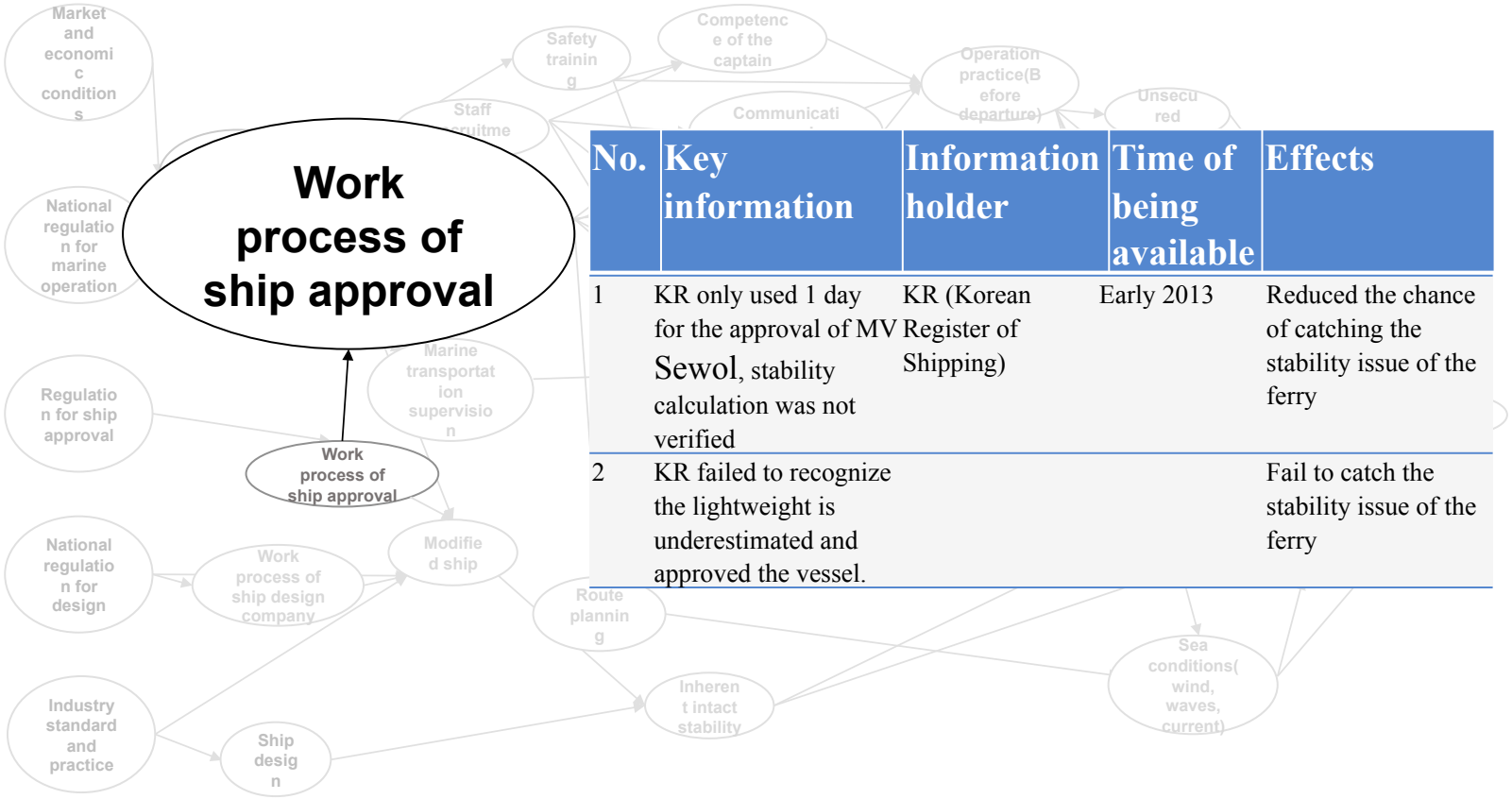
Information collection



No.	Key information	Information holder	Time of being available	Effects
1	KR only used 1 day for the approval of MV Sewol, stability calculation was not verified	KR (Korean Register of Shipping)	Early 2013	Reduced the chance of catching the stability issue of the ferry
2	KR failed to recognize the lightweight is underestimated and approved the vessel.			Fail to catch the stability issue of the ferry

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Information collecting and integrating

2007

Regulation for ship approval

Market and economic conditions

National regulation for marine operation

National regulation for design

Industry standard and practice

Conceptual capsizing **prob.**

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2007

From: shipping sector
"The profit margin is shrinking!!!"

Market and economic conditions

Regulation for ship approval

National regulation for marine operation

National regulation for design

Industry standard and practice

Conceptual capsizing **prob.**

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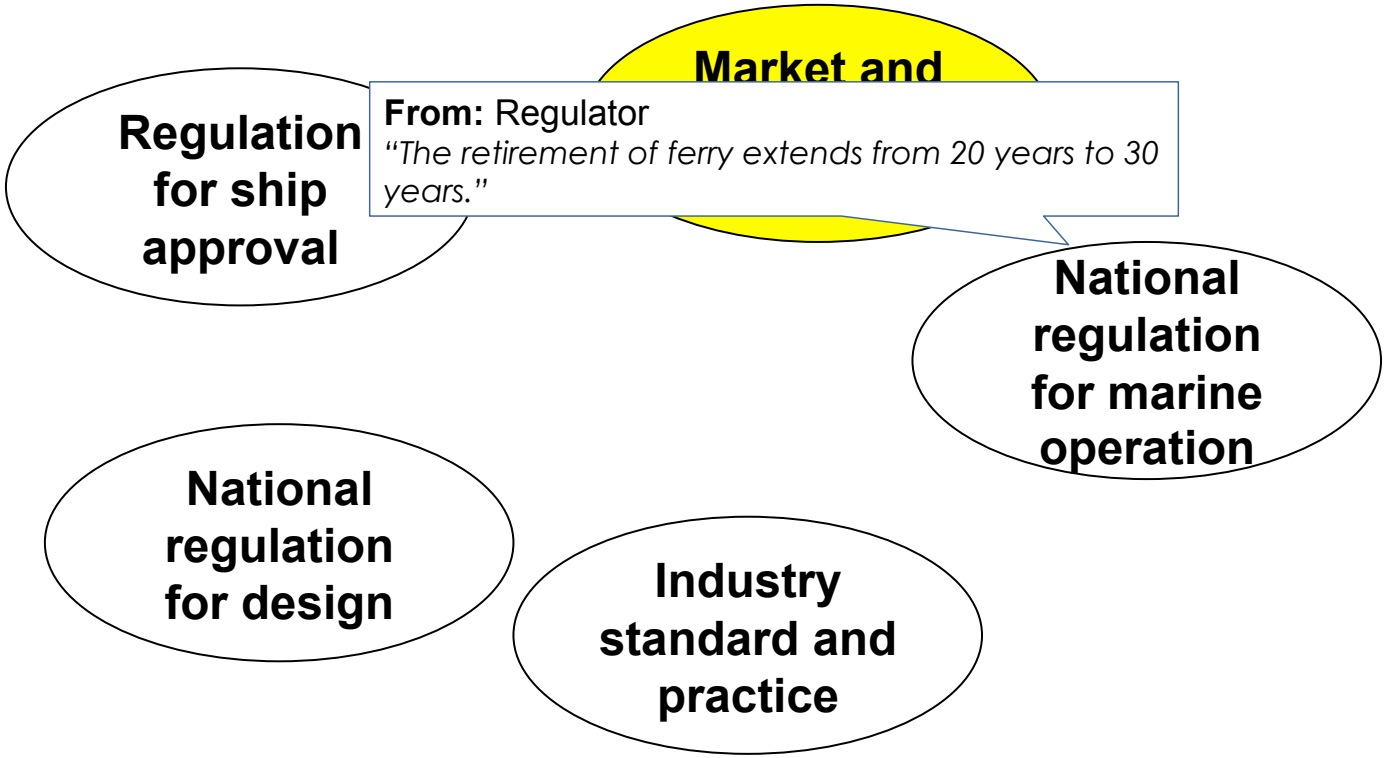
2008



Conceptual capsizing **prob.**

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2008

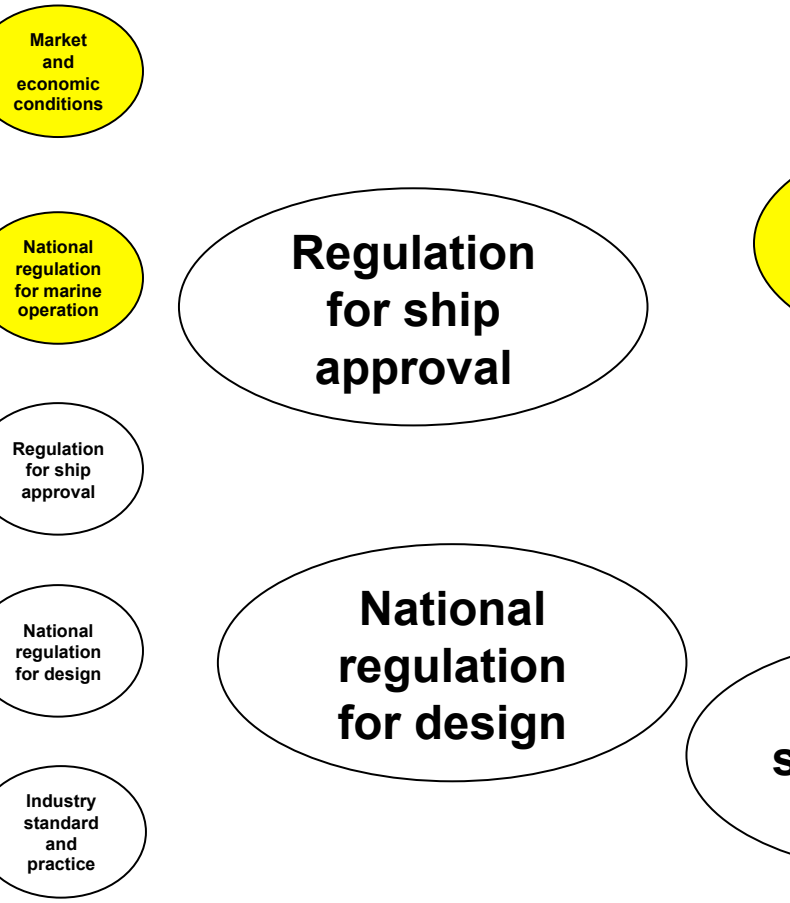
Market and economic conditions

National regulation for marine operation

Regulation for ship approval

National regulation for design

Industry standard and practice



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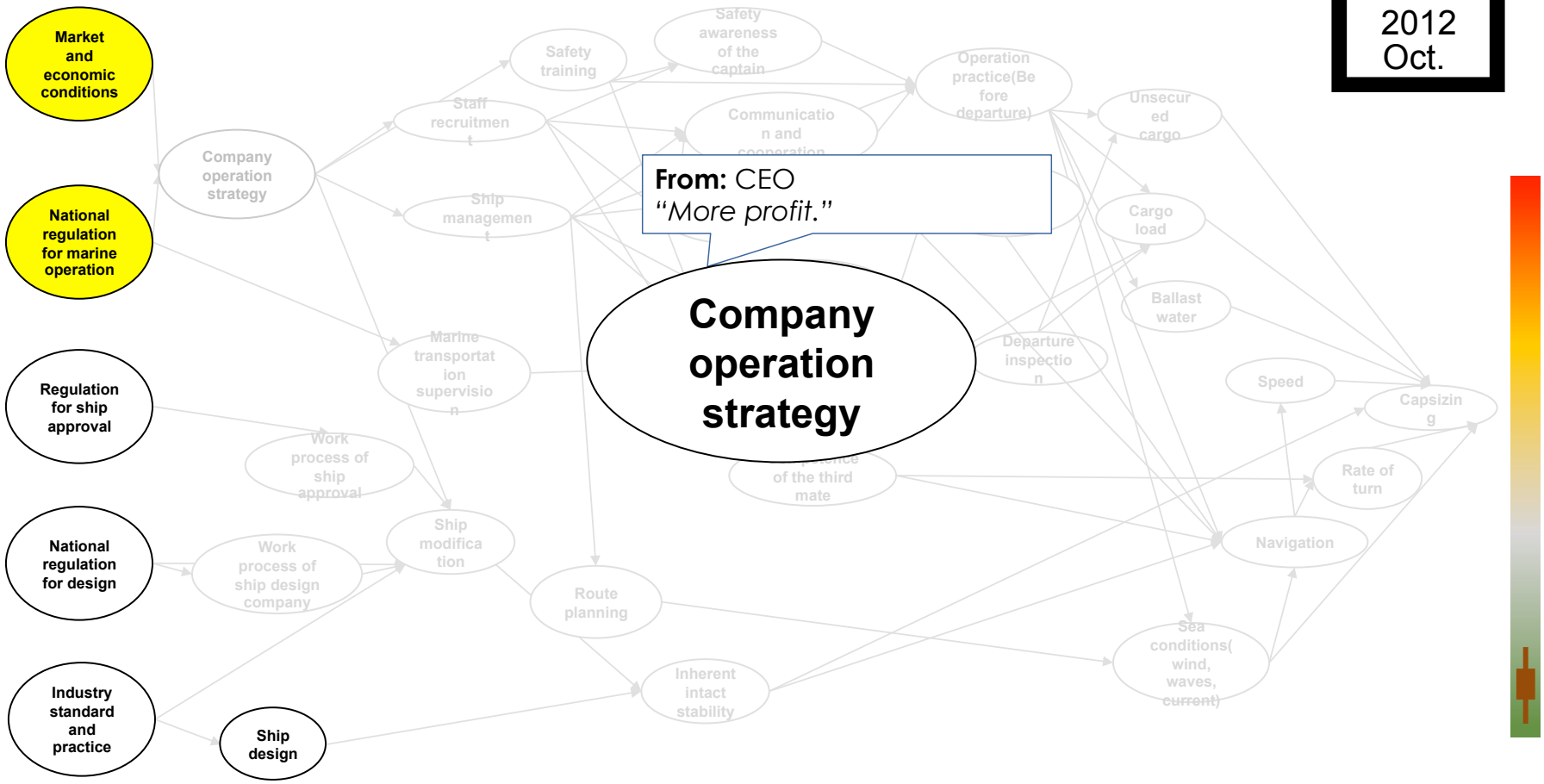
Ferry remodeling phase

2012 Oct.



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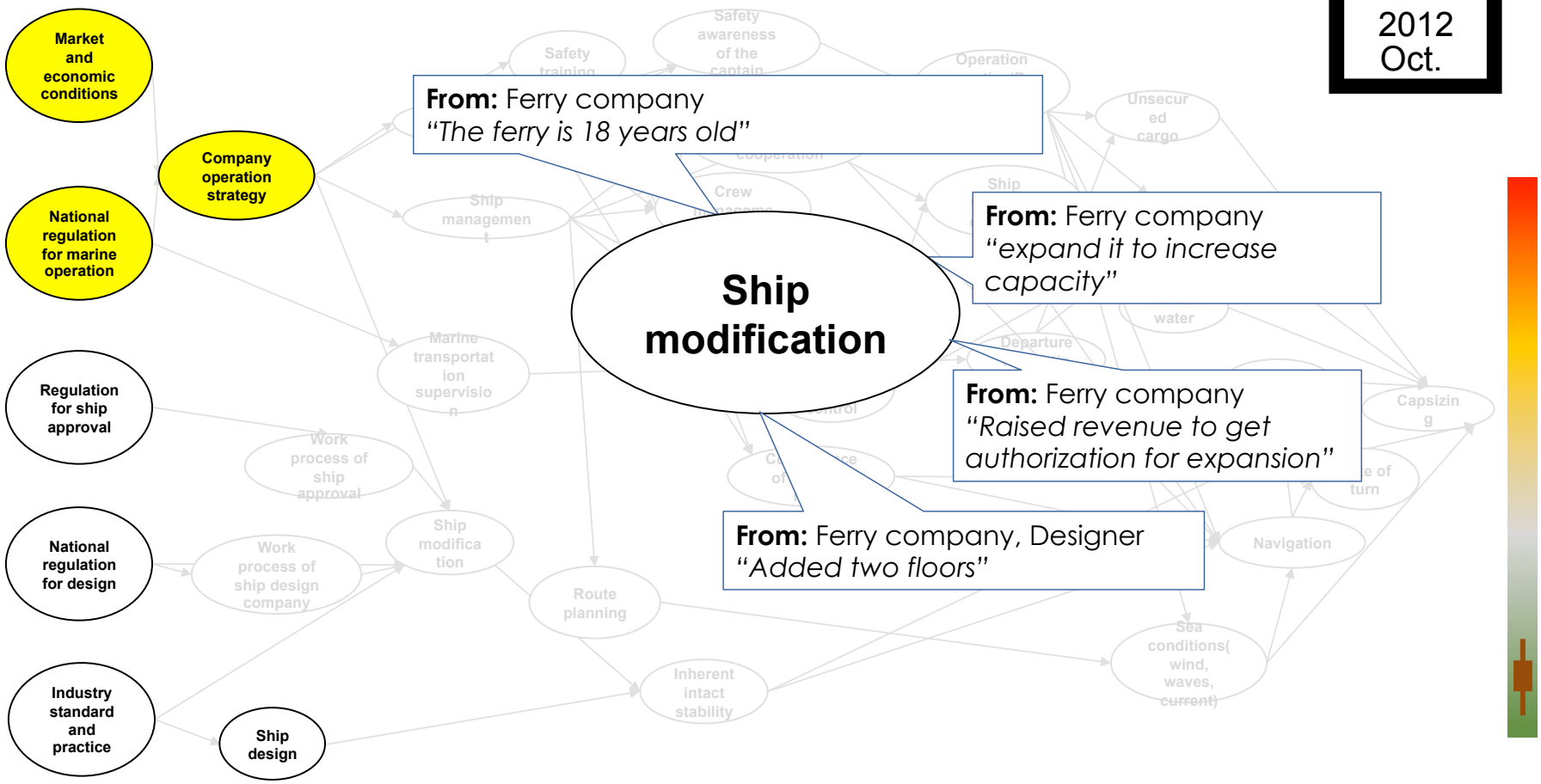
Ferry remodeling phase

2012
Oct.



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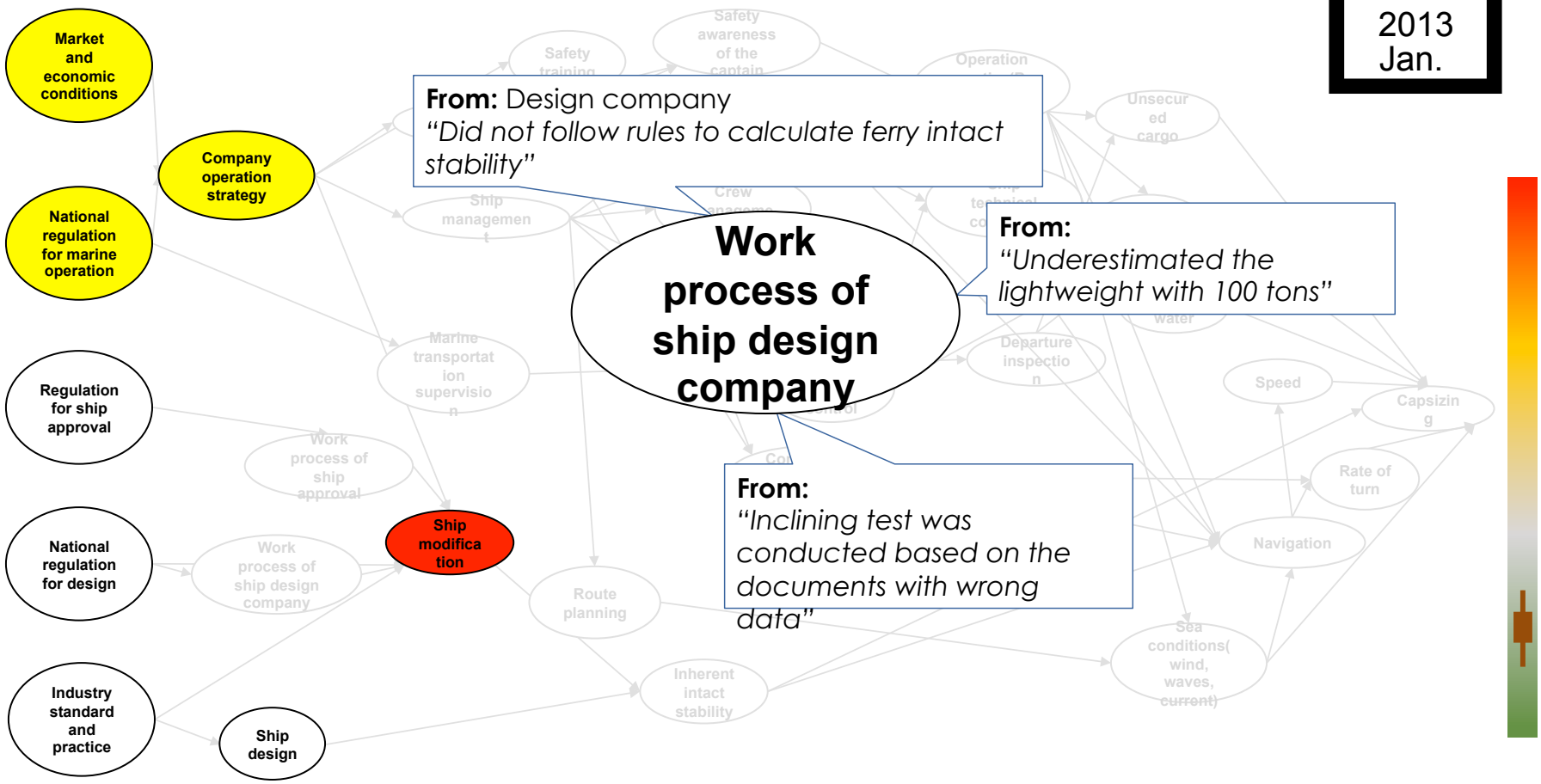
Ferry remodeling phase

2013
Jan.



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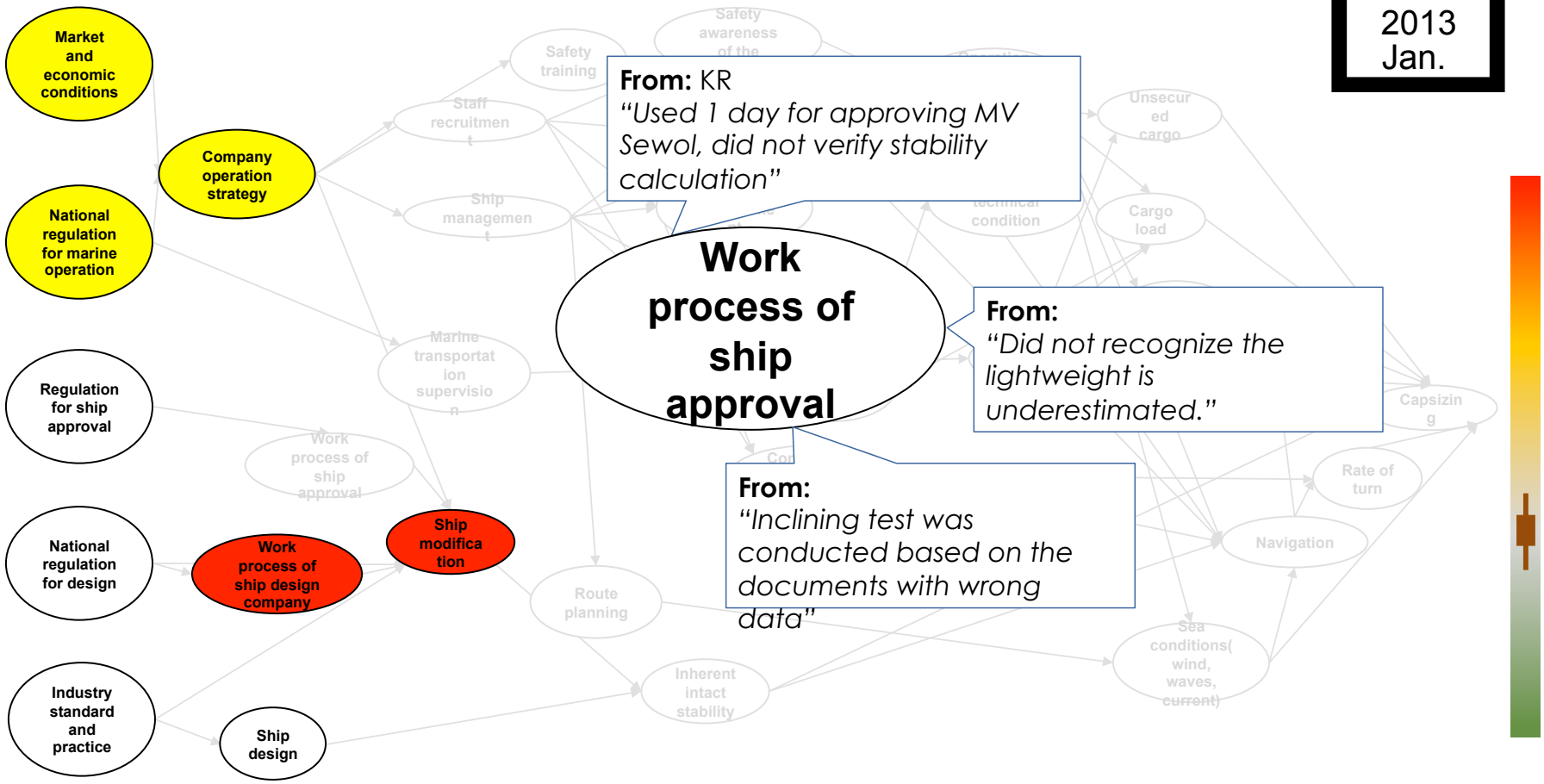
Ferry remodeling phase

2013
Jan.



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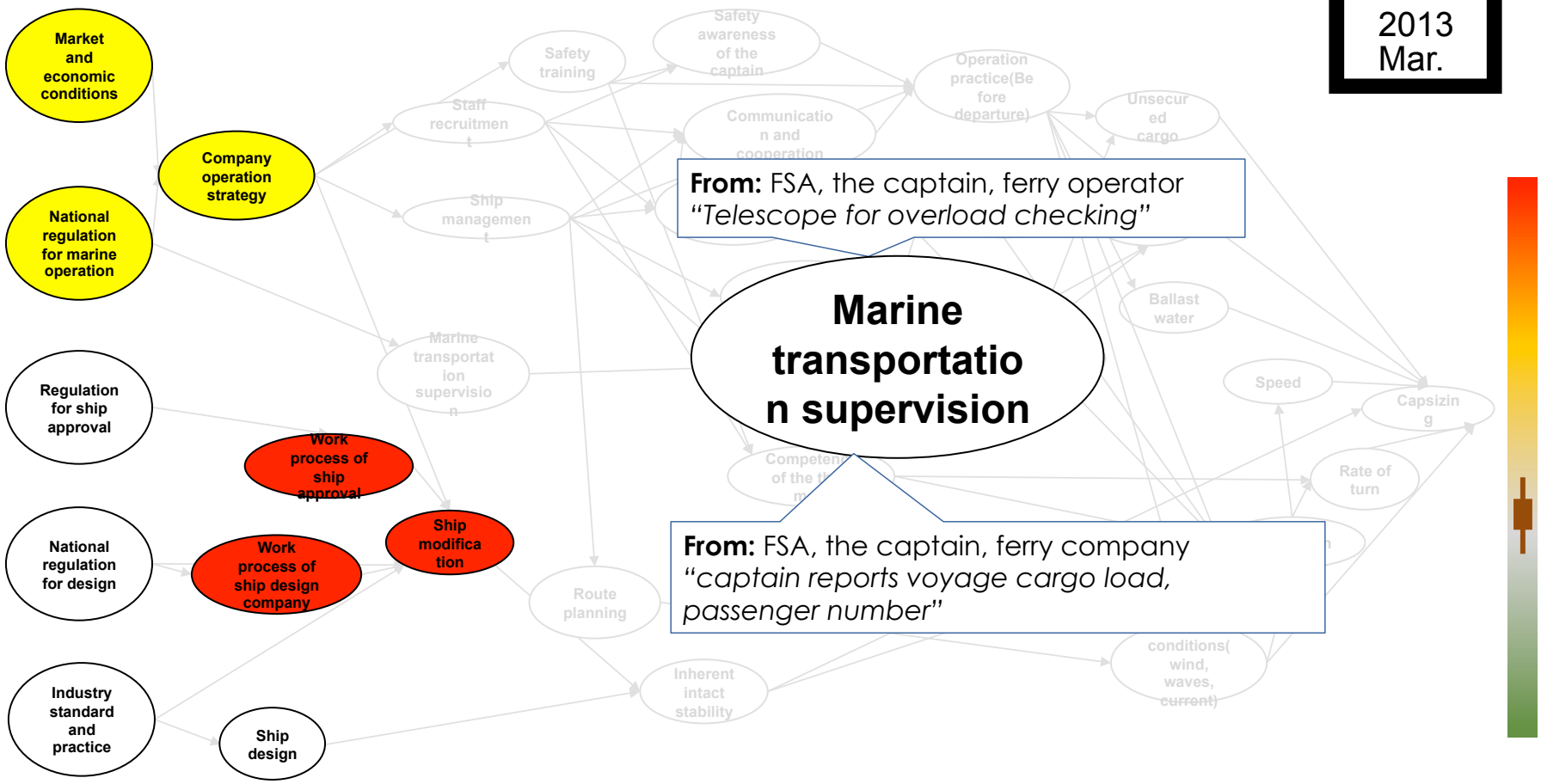
Operation preparation phase

2013 Mar.



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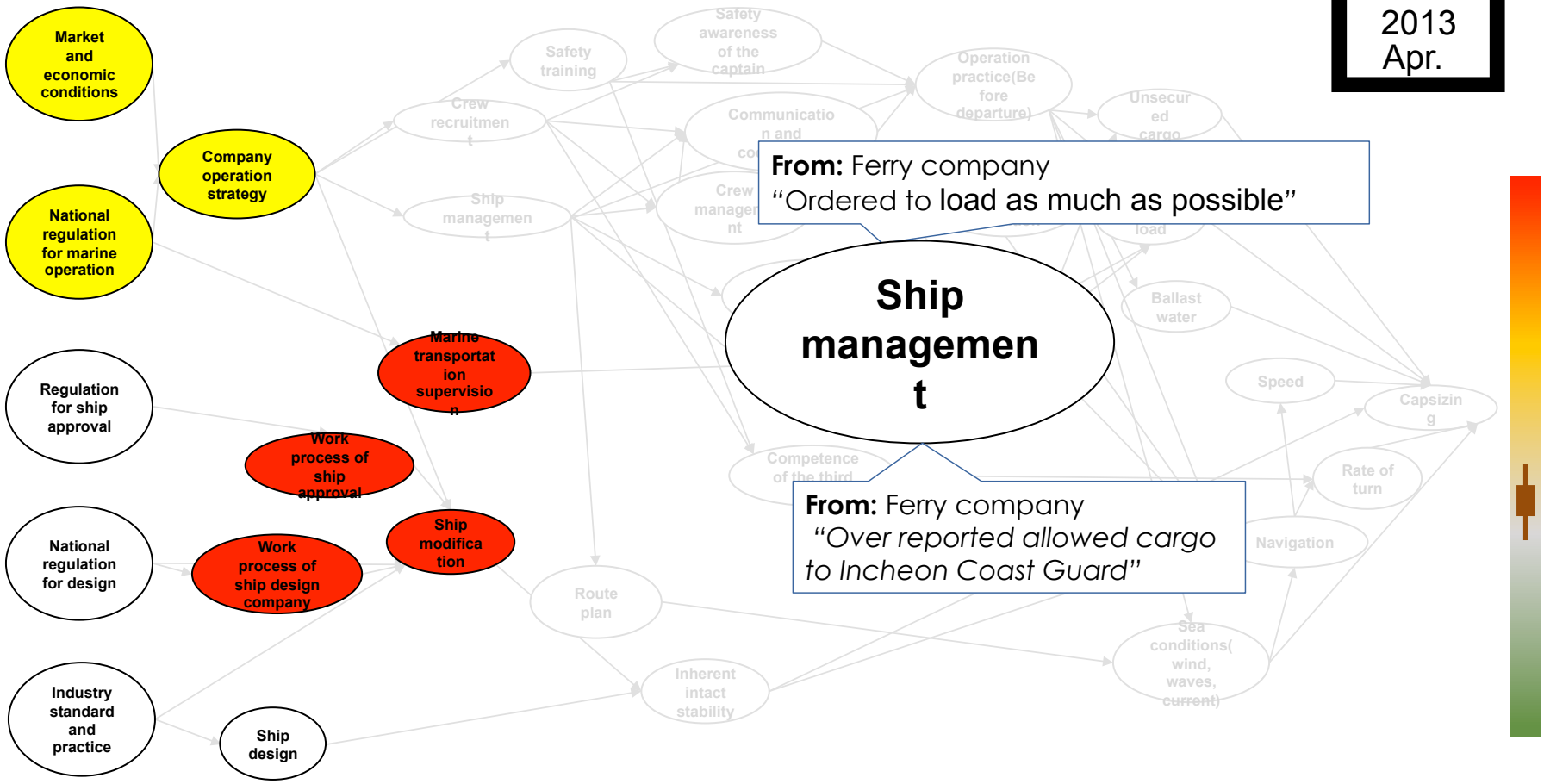
Operation preparation phase

2013 Apr.



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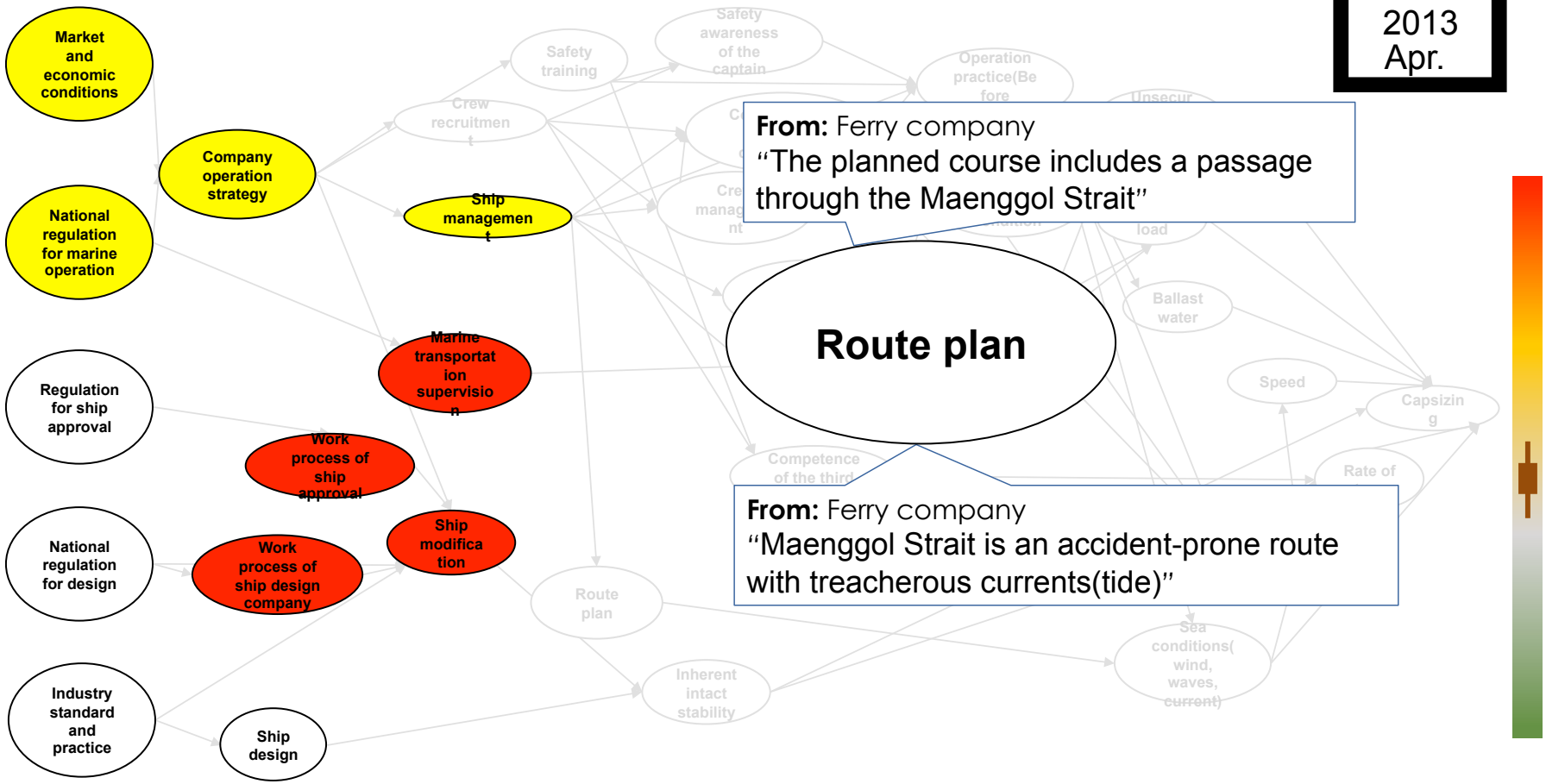
Operation preparation phase

2013 Apr.



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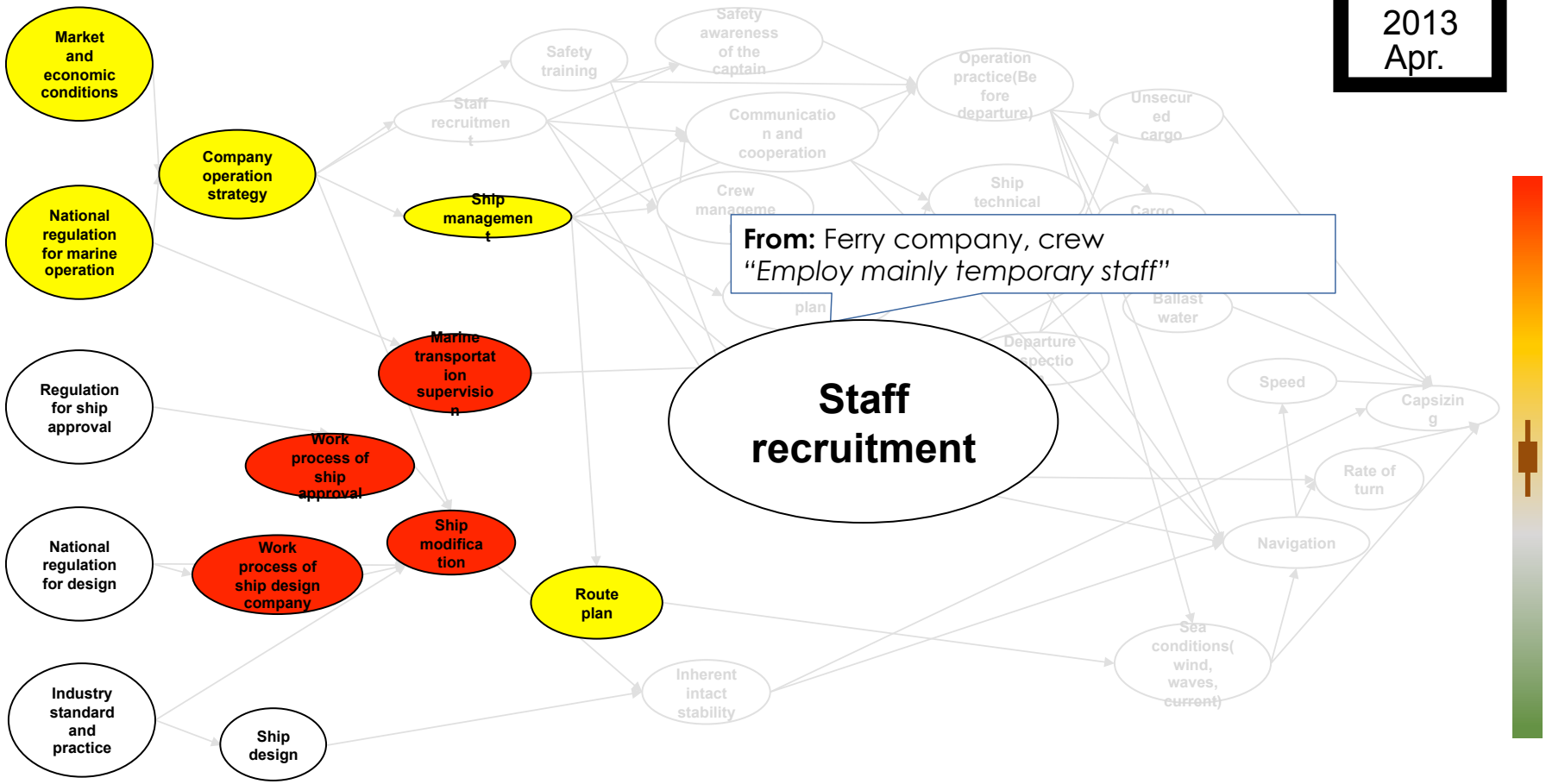
Operation preparation phase

2013
Apr.



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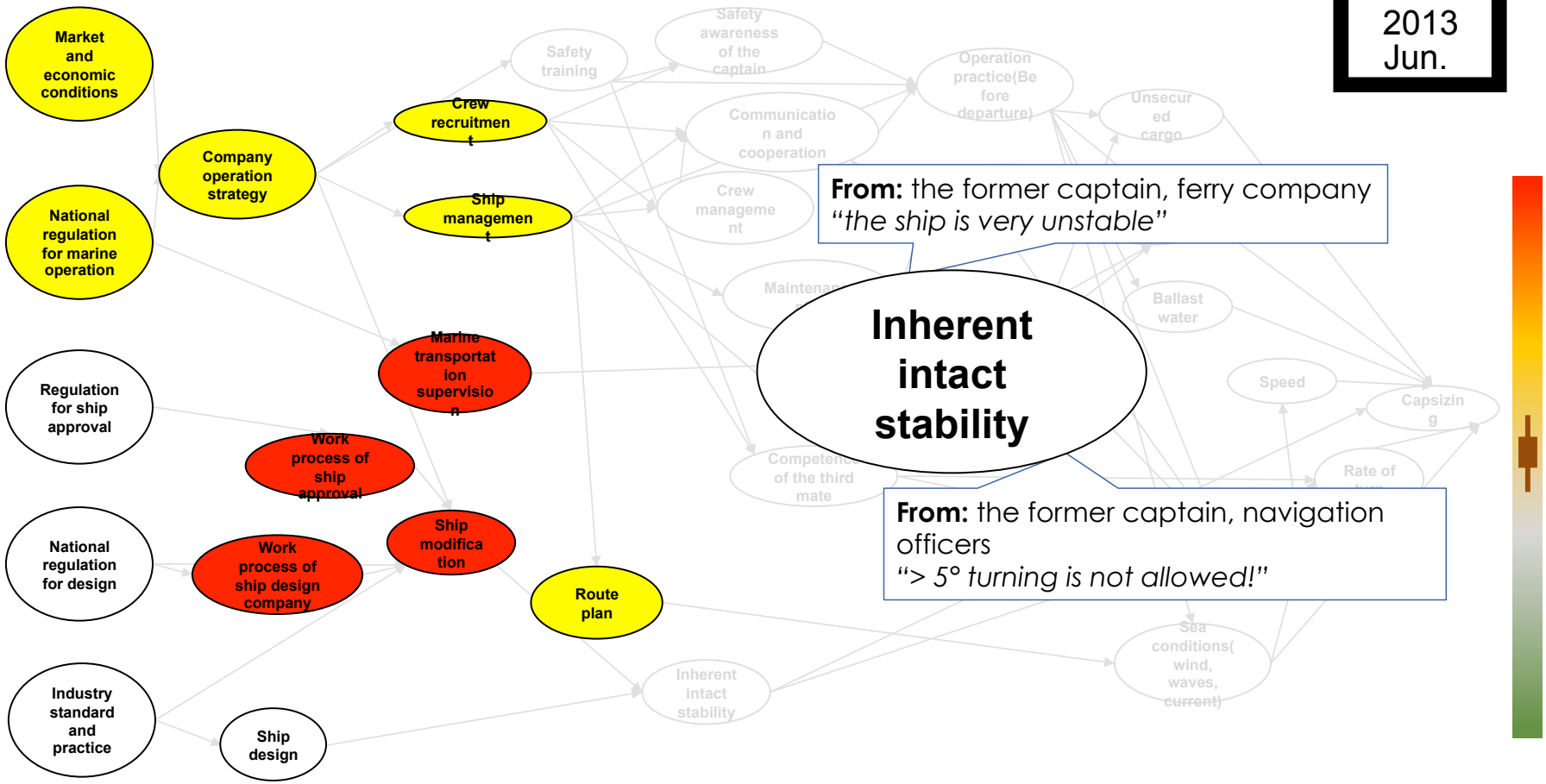
Operation phase

2013
Jun.



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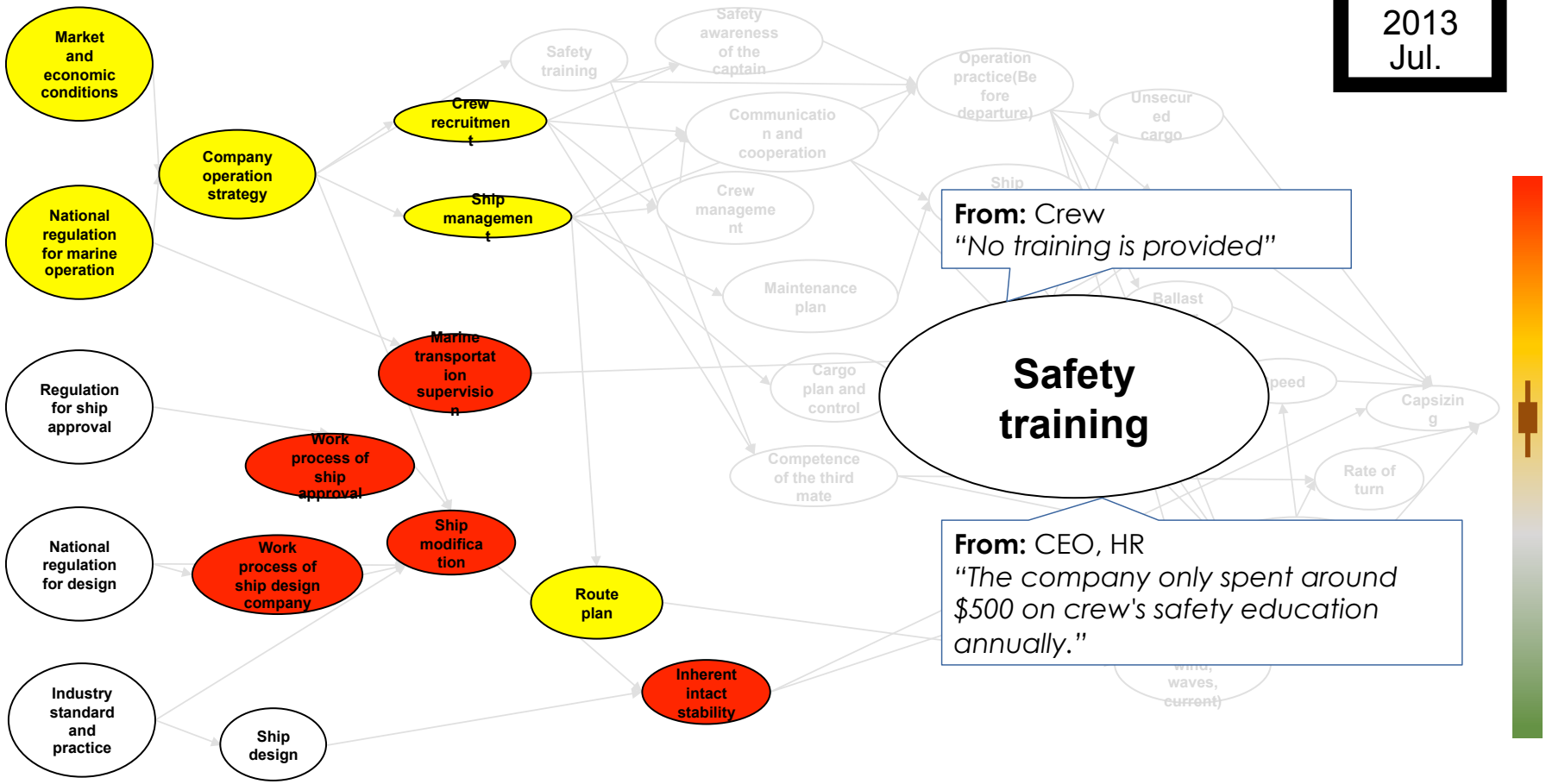
Operation phase

2013
Jul.



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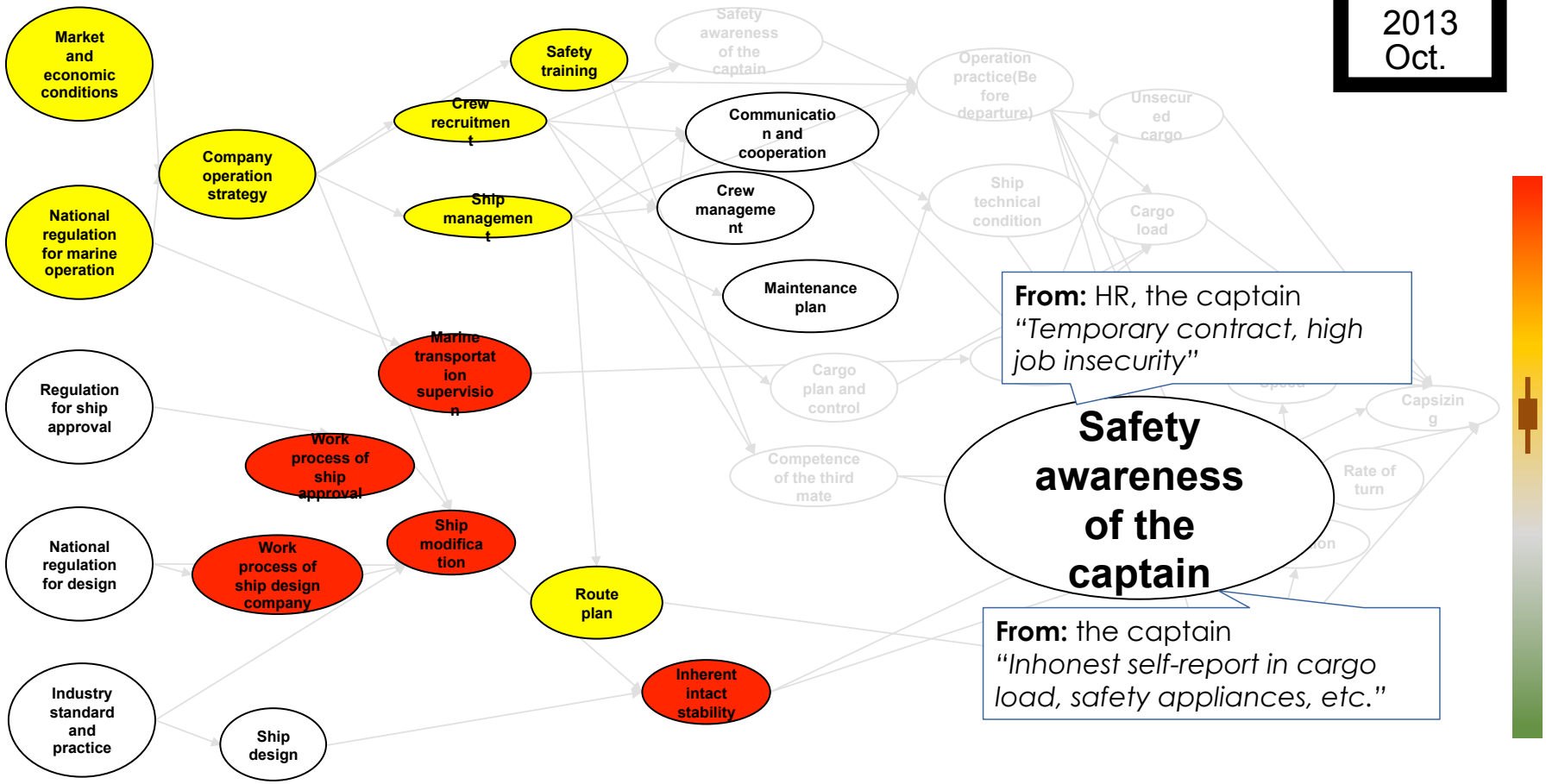
Operation phase

2013 Oct.



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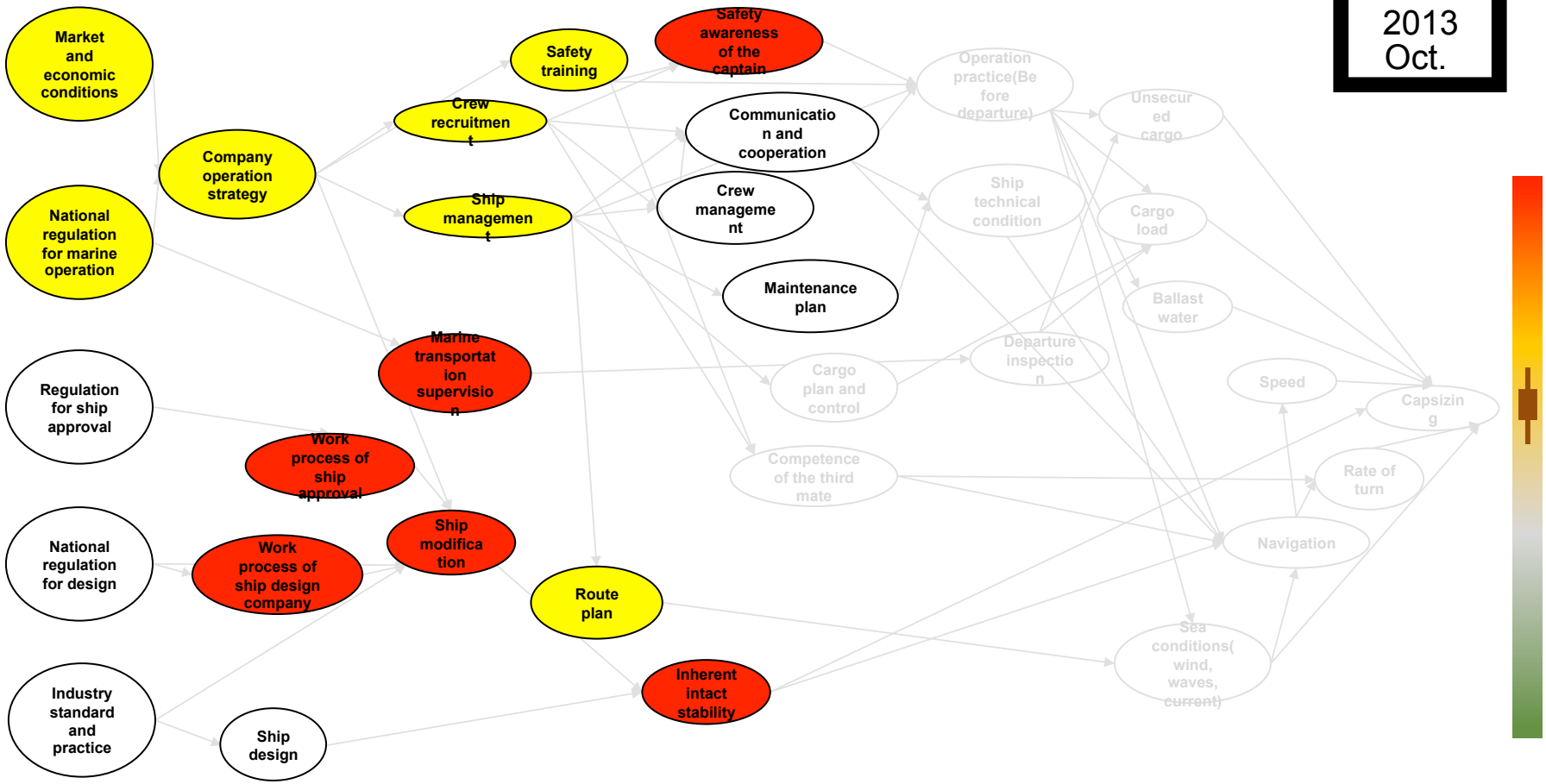
Operation phase

2013 Oct.



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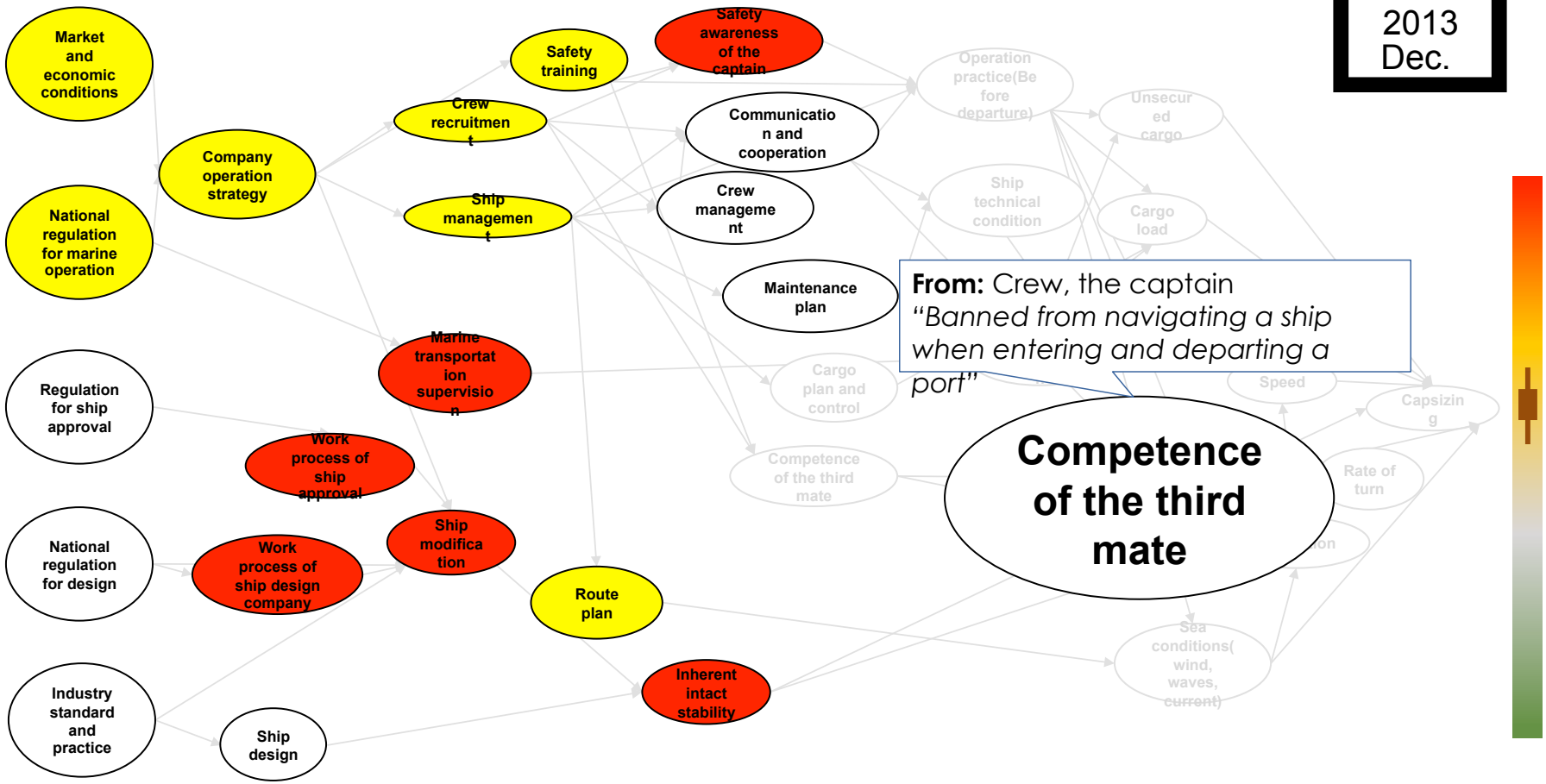
Operation phase

2013 Dec.



From: Crew, the captain
"Banned from navigating a ship when entering and departing a port"

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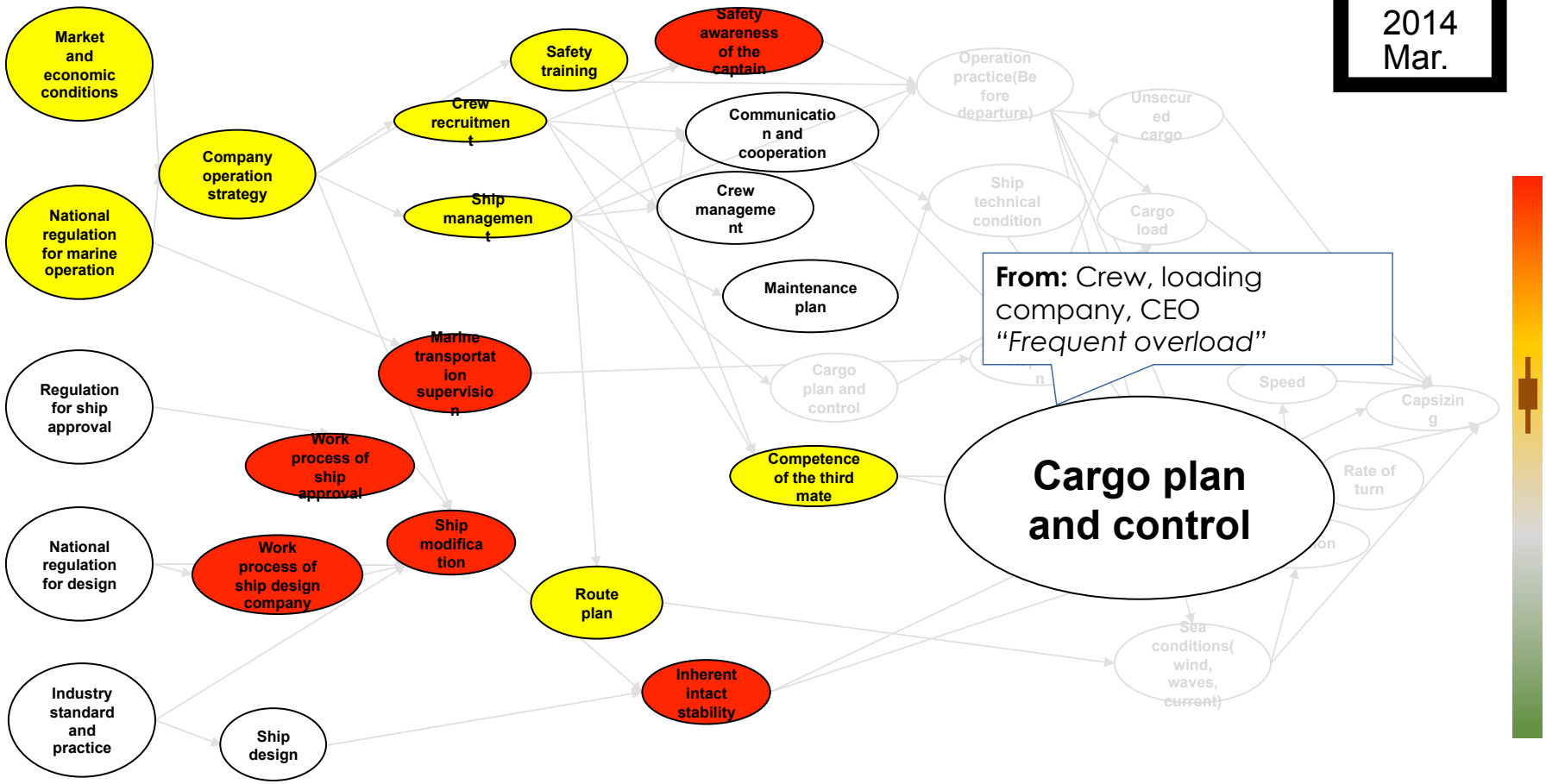
Operation phase

2014 Mar.



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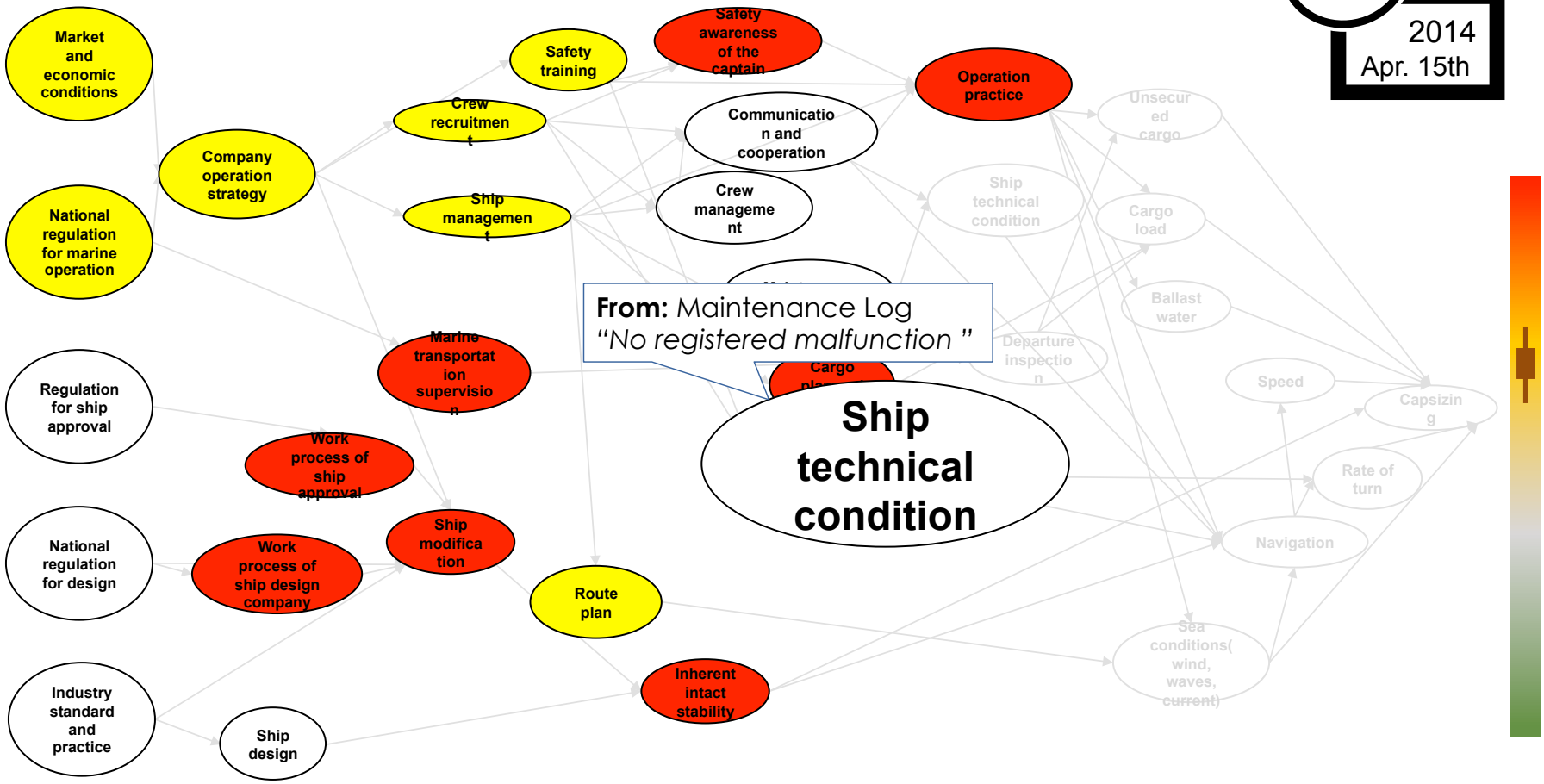
Voyage preparation

2014
Apr. 15th



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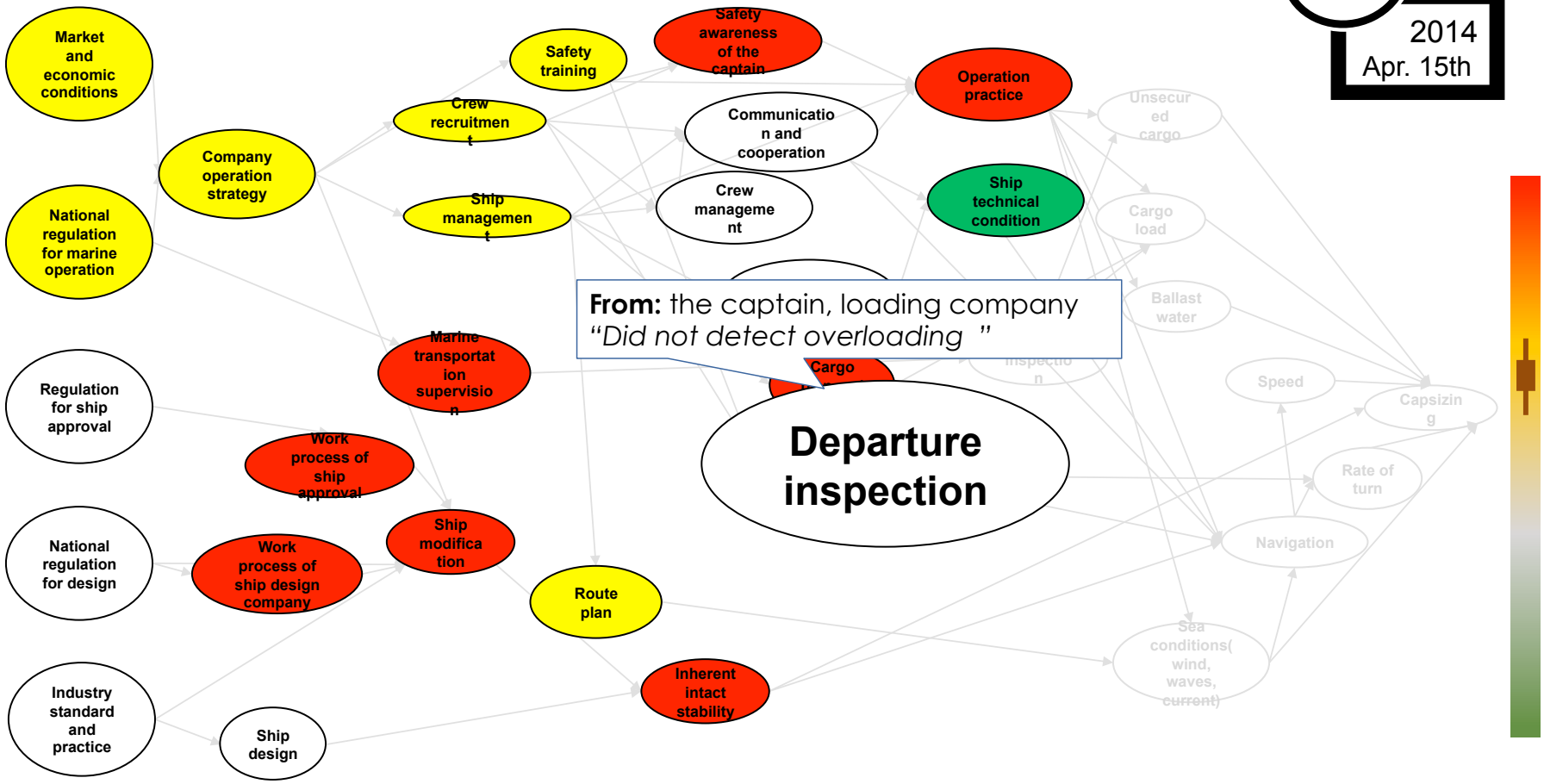
Voyage preparation

2014
Apr. 15th



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Voyage preparation

2014
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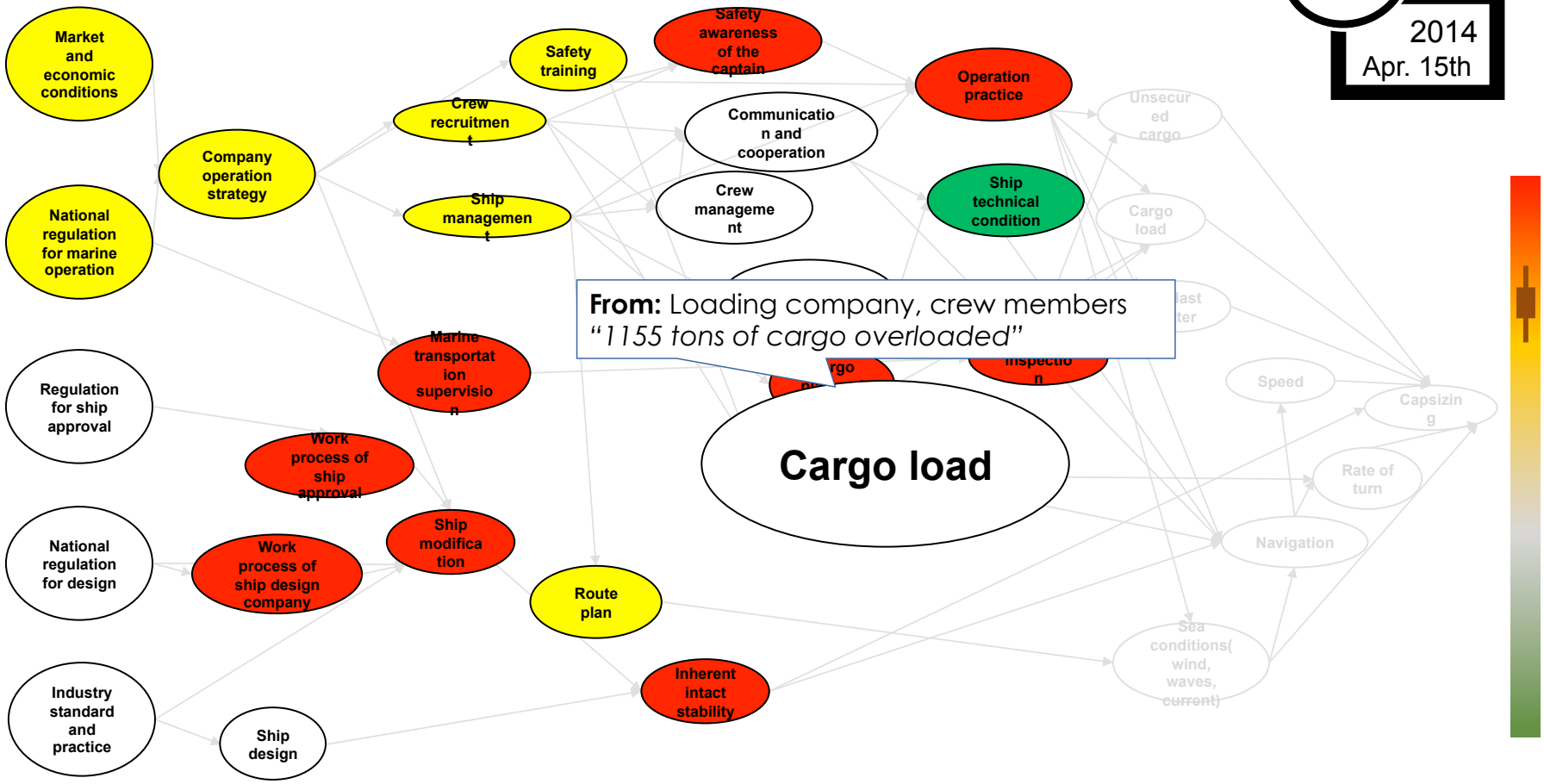

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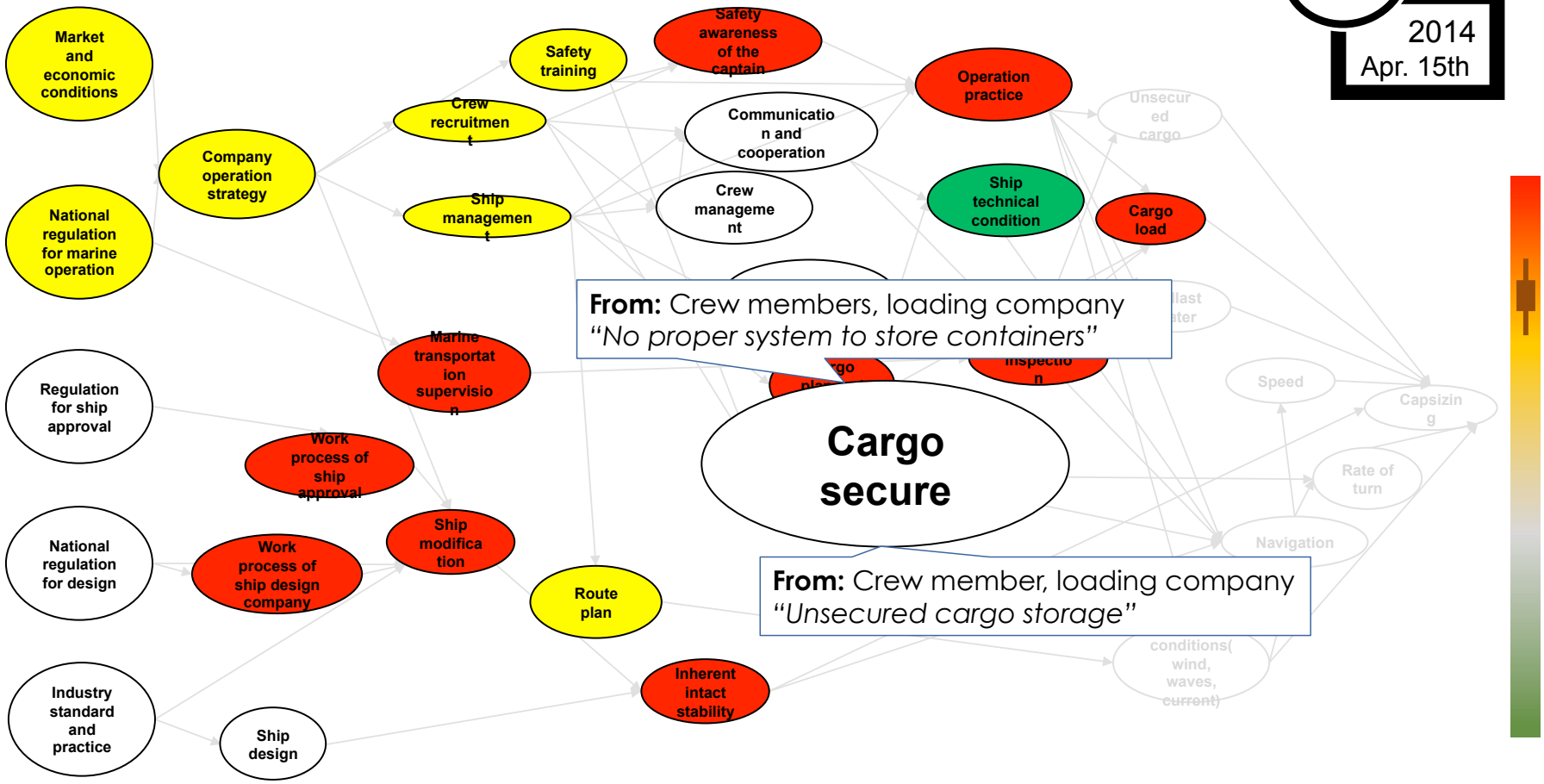
Voyage preparation

2014
Apr. 15th



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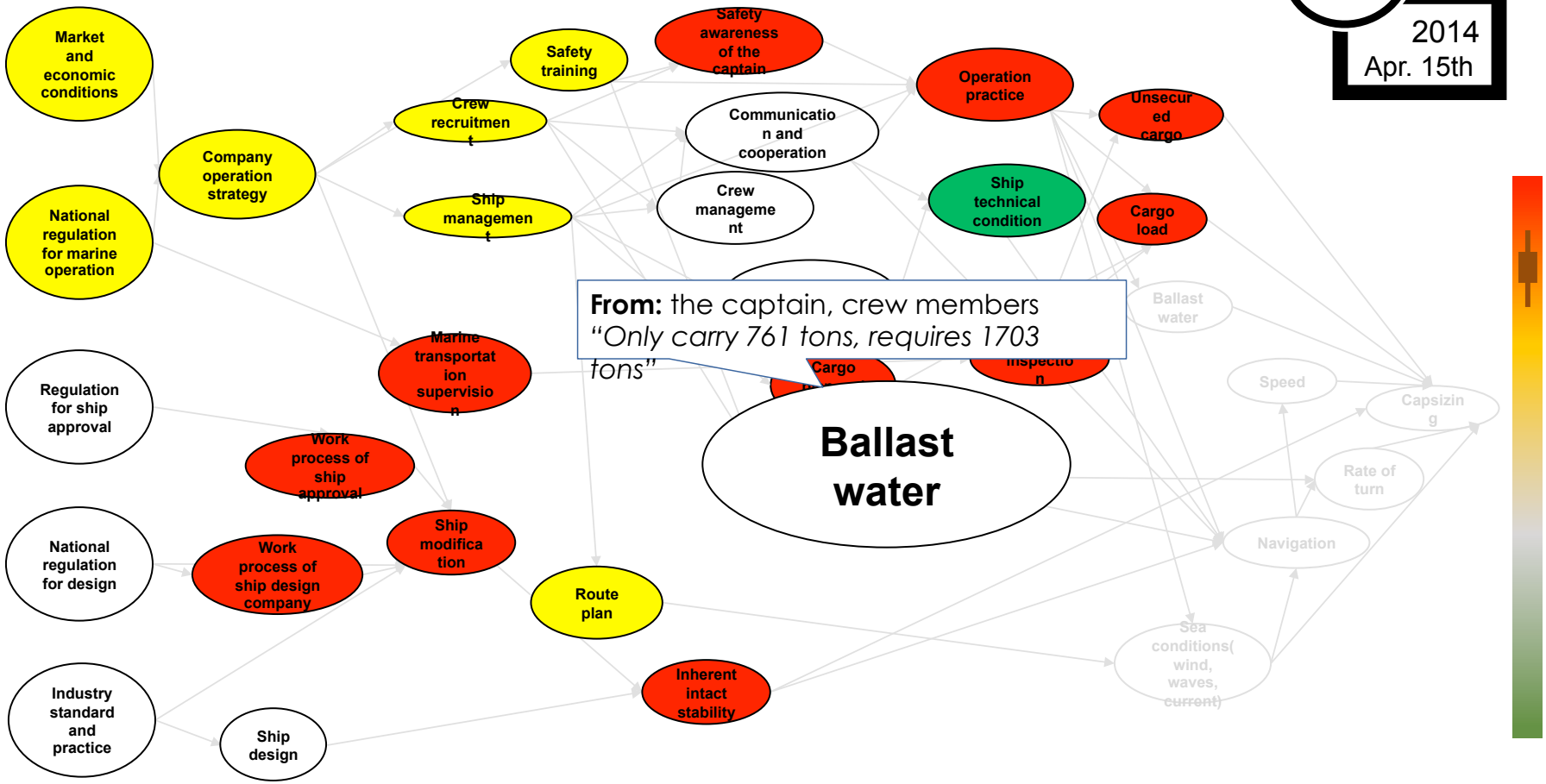
Voyage preparation

2014
Apr. 15th



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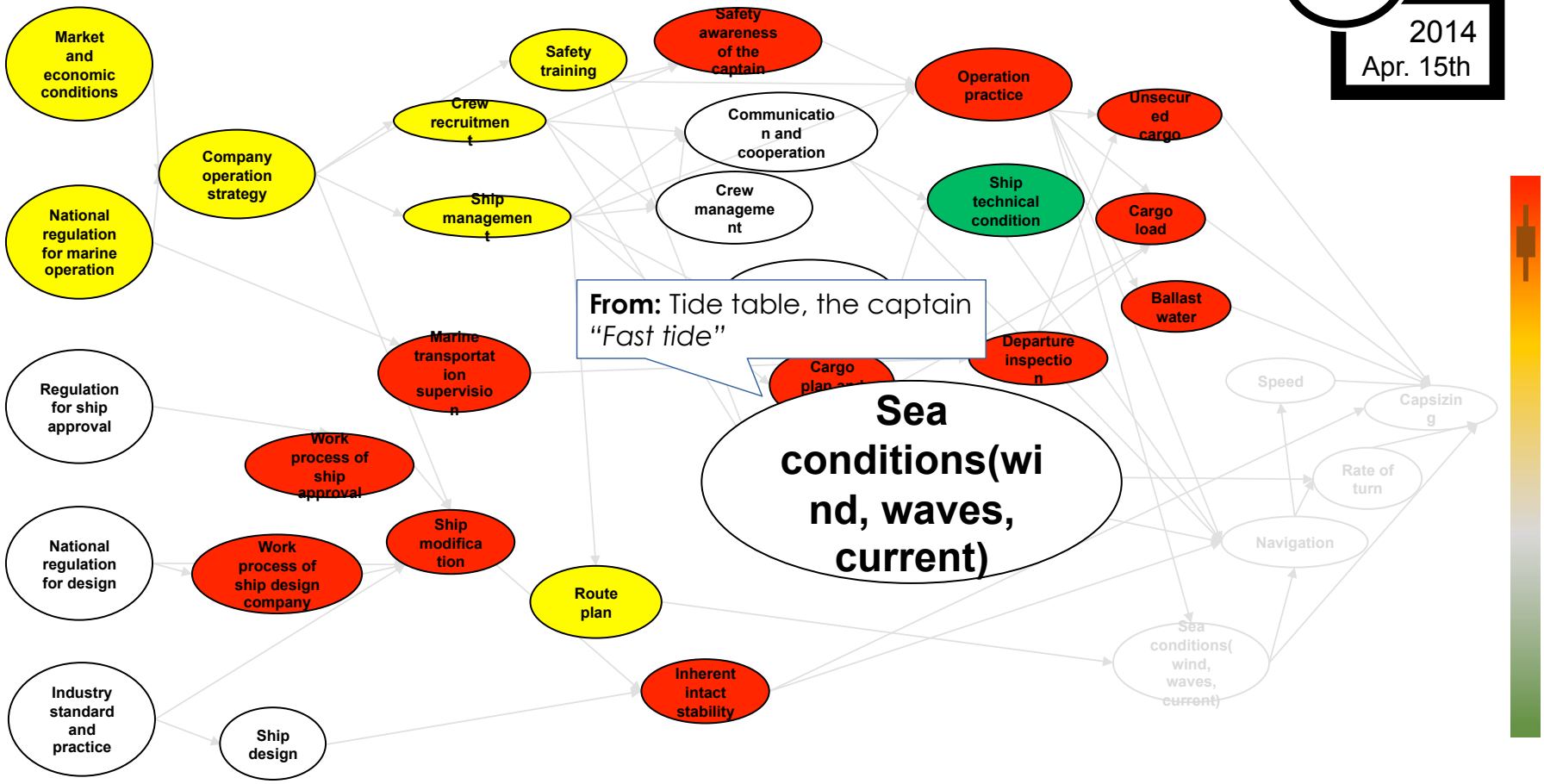
Ship navigation

2014
Apr. 15th



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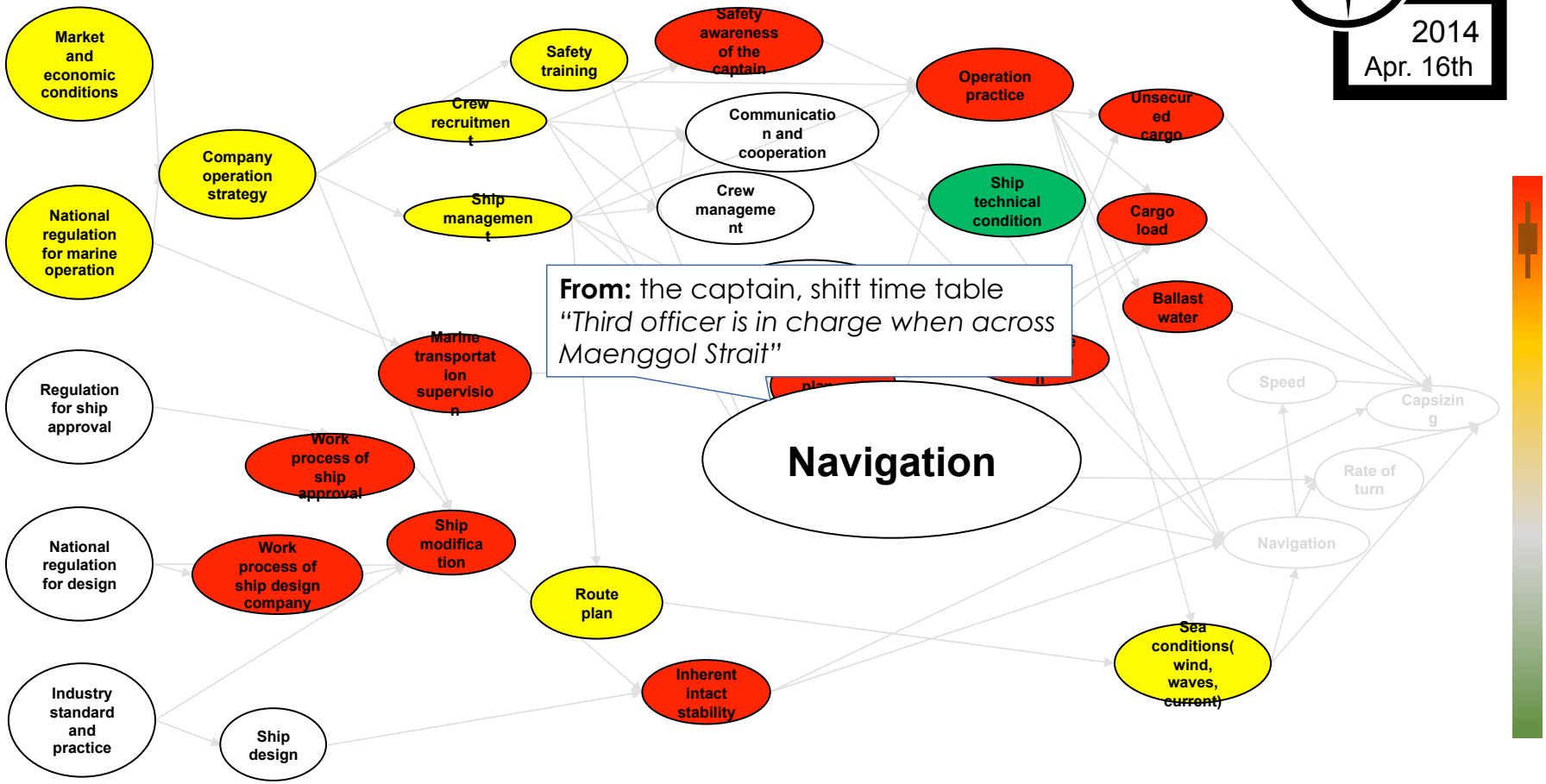
Ship navigation

2014
Apr. 16th



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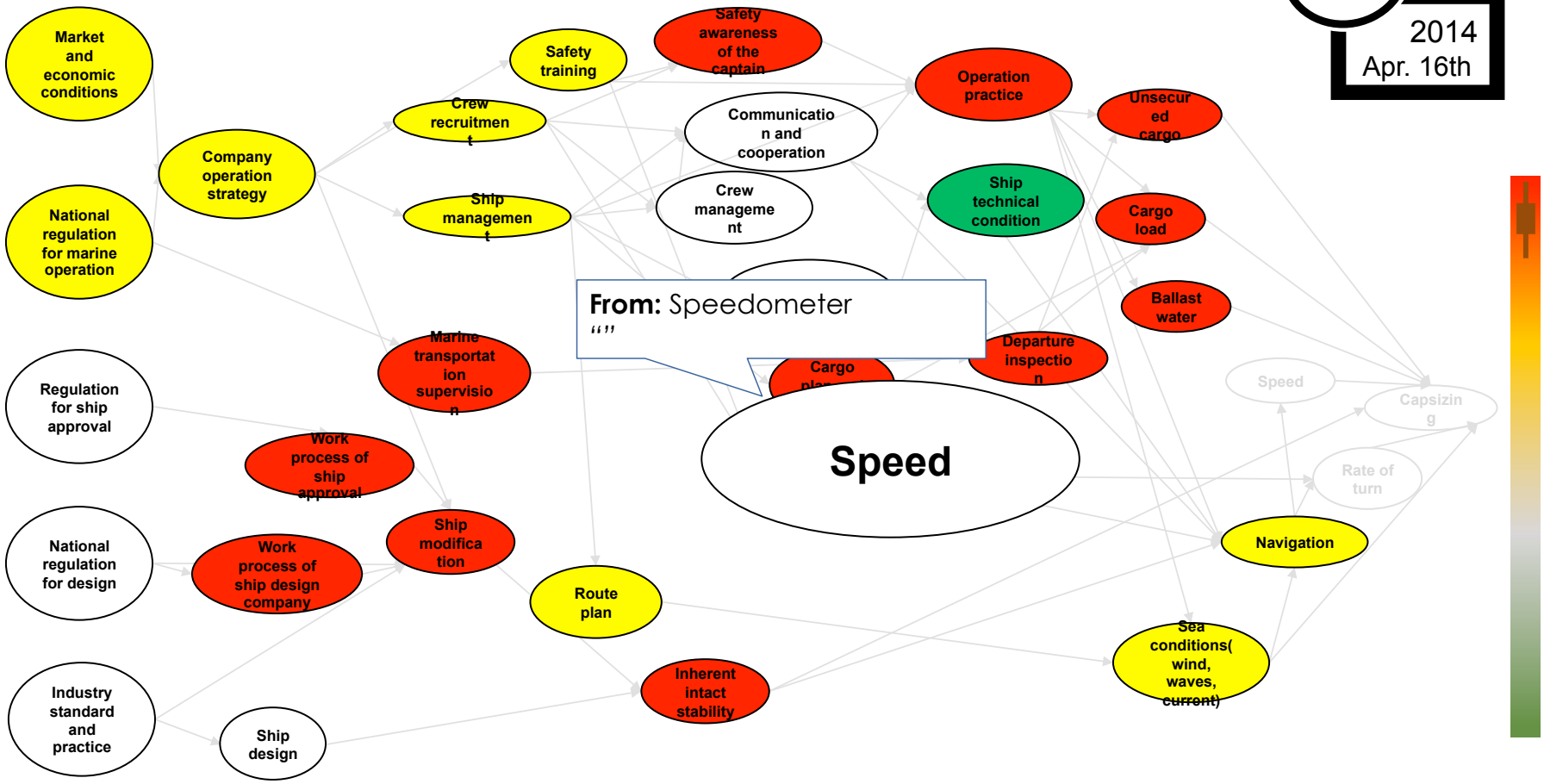
Ship navigation

2014
Apr. 16th



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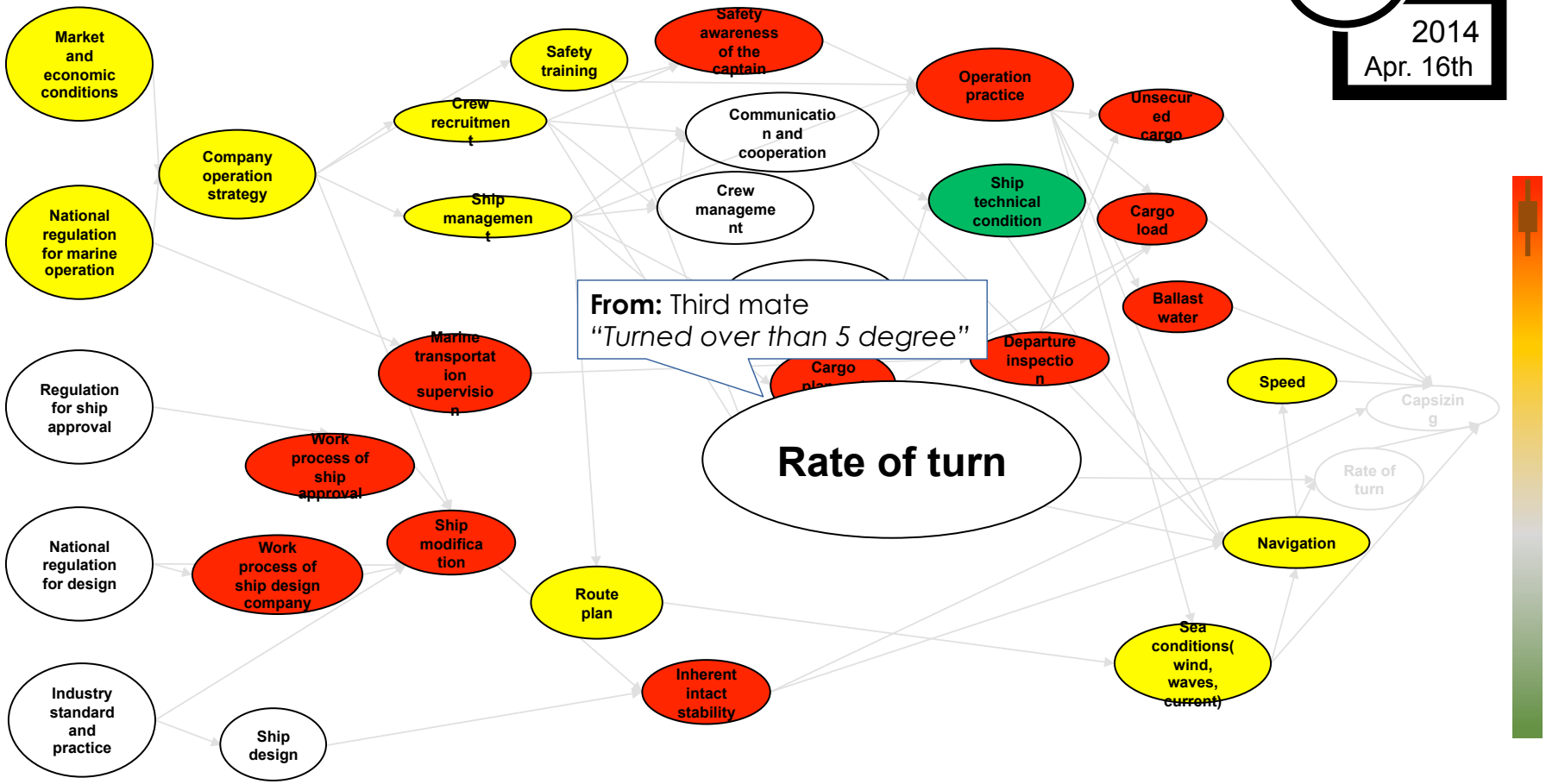
Ship navigation

2014
Apr. 16th



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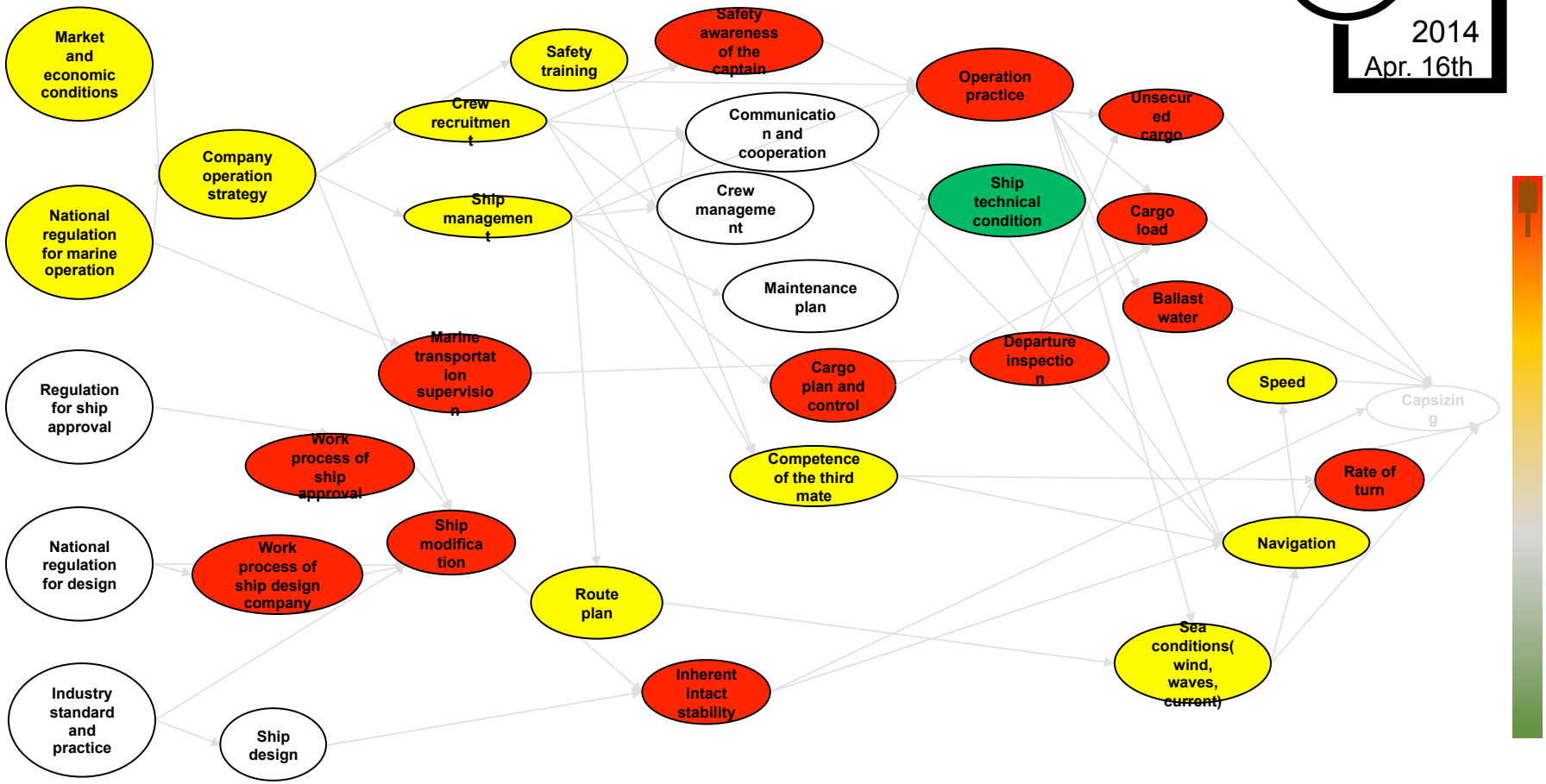
Ship navigation

2014
Apr. 16th



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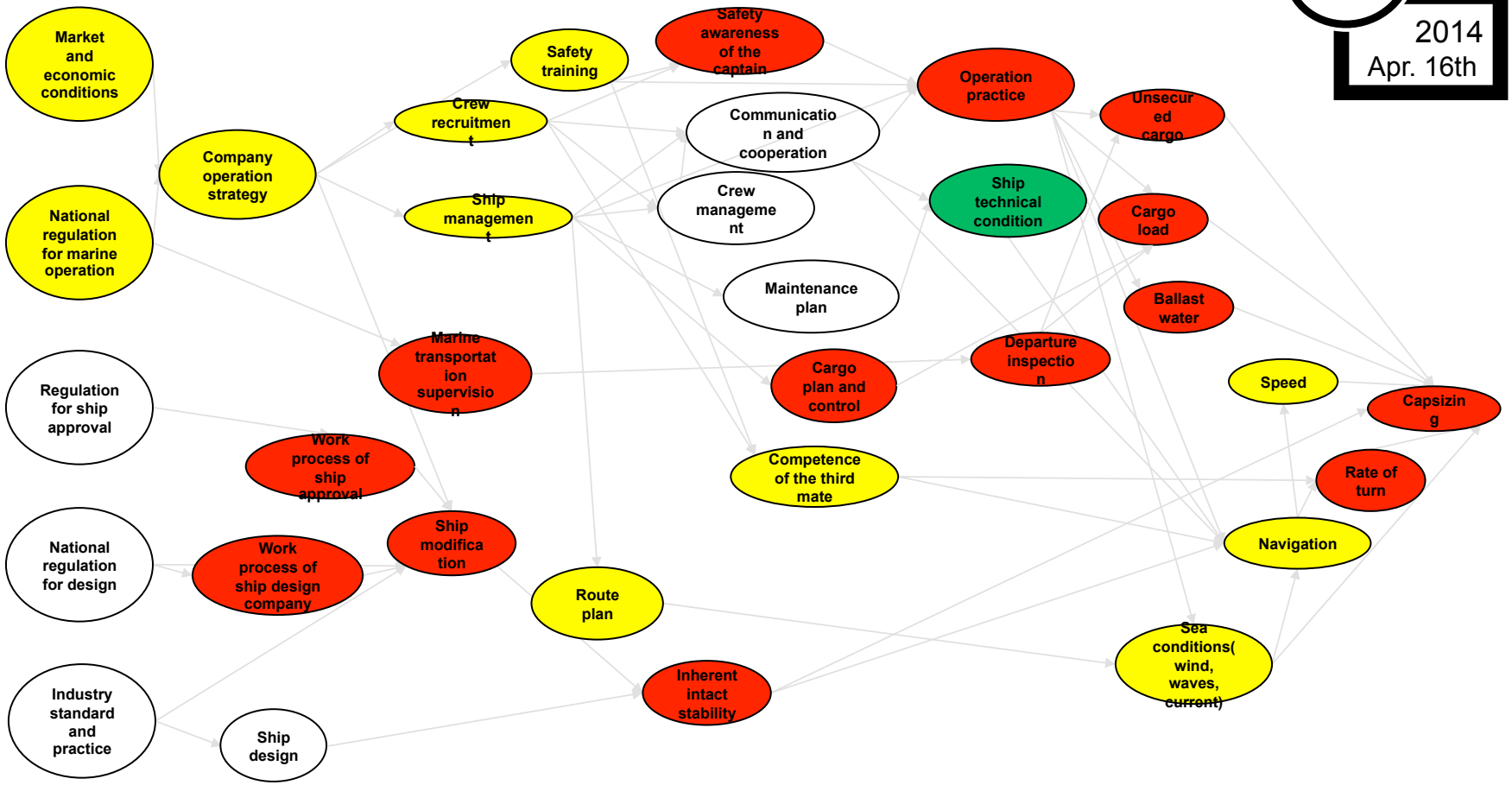
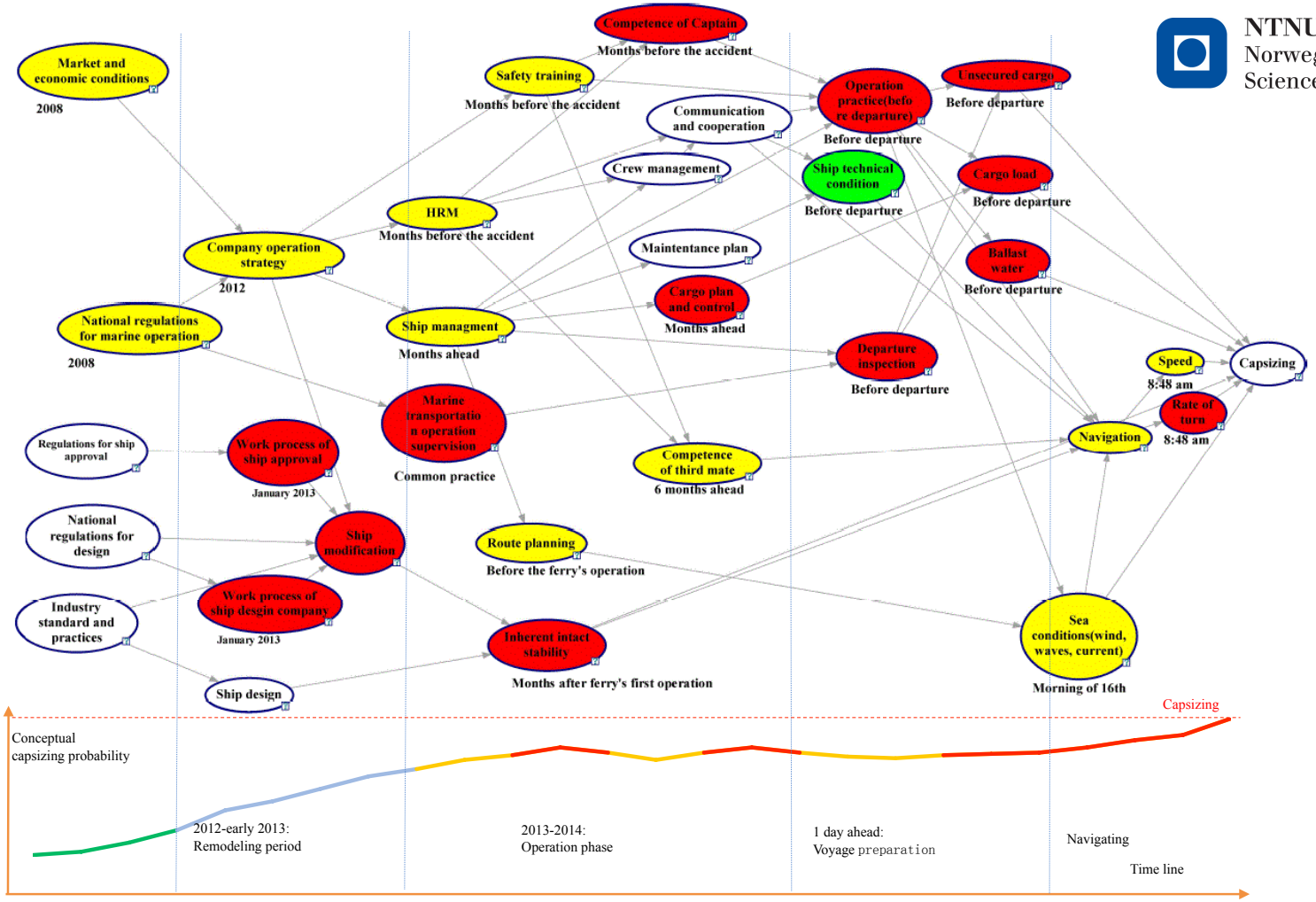
Listing

2014
Apr. 16th




Competence of Captain
Months before the accident
Market and economic conditions
2008
Safety training
Months before the accident
Communication and cooperation
Operation practice(before departure)
Before departure
Unsecured cargo
Before departure
Crew management
Ship technical condition
Before departure
Cargo load
Before departure
HRM
Months before the accident
Company operation strategy
2012
Maintentance plan
Ballast water
Before departure
Cargo plan and control
Months ahead
National regulations for marine operation
2008
Ship managment
Months ahead
Departure inspection
Before departure
Speed
8:48 am
Capsizing
Marine transportation operation supervision
Common practice
Rate of turn
8:48 am
Regulations for ship approval
Work process of ship approval
January 2013
Competence of third mate
6 months ahead
Navigation
National regulations for design
Ship modification
Route planning
Before the ferry's operation
Industry standard and practices
Work process of ship desgin company
January 2013
Sea conditions(wind, waves, current)
Morning of 16th
Inherent intact stability
Months after ferry's first operation
Ship design
Capsizing
Conceptual capsizing probability
2012-early 2013:
Remodeling period
2013-2014:
Operation phase
1 day ahead:
Voyage preparation
Navigating
Time line

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Conclusions

1. The capsizing is not a surprise

2. A well-developed capsizing accident model and information availability is very useful for accident prediction

3. It provides hints in where and when to collect information for accident prediction

4. It indicates that different strategies can be applied at different system components at varied time for accident prevention.

Thank you!!!

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