



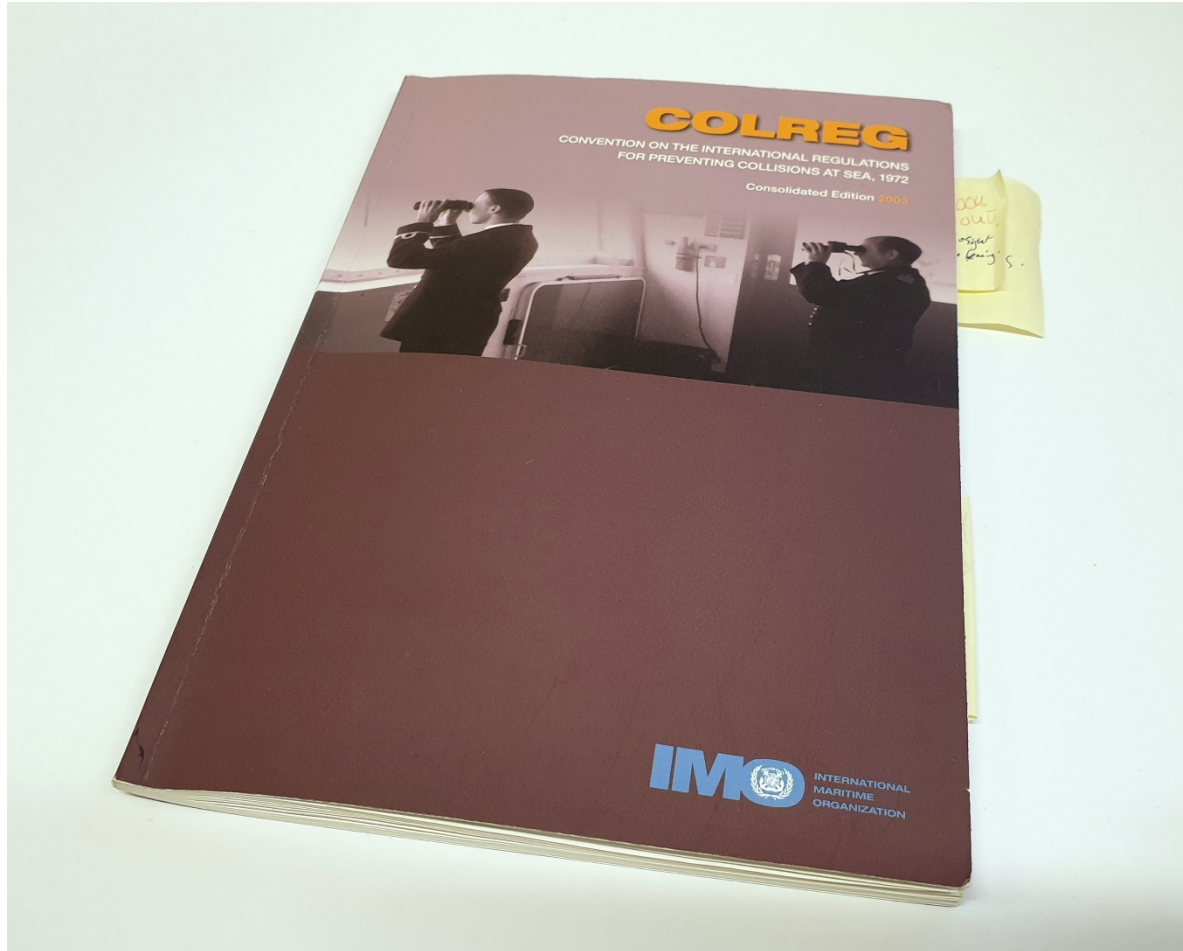
# COLREG compliance for autonomous navigation systems

MTEC/ICMASS 2019

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# International Regulations for Preventing Collisions at Sea (COLREG)



- Published 1972 – entered into force 1977
- National authorities responsible for implementation
- Amended several times since first adoption
- Does not specifically require manning
- Applies to ALL vessels\*

Source; IMO, Wikipedia

## COLREG Structure

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Part A - General (Rules 1-3)

Part B- Steering and Sailing (Rules 4-19)

Part C Lights and Shapes (Rules 20-31)

Part D - Sound and Light Signals (Rules 32-37)

Part E - Exemptions (Rule 38)

Part F - Verification of compliance with the provisions of the Convention

Annex I–IV – Details on lights, shapes, signals and related appliances

\*Local rules – Determined by local administrations

# Automated Navigation





# Classic navigation

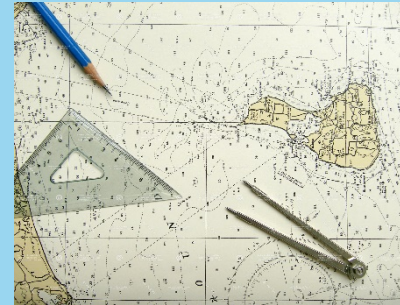
Information acquisition



Information analysis



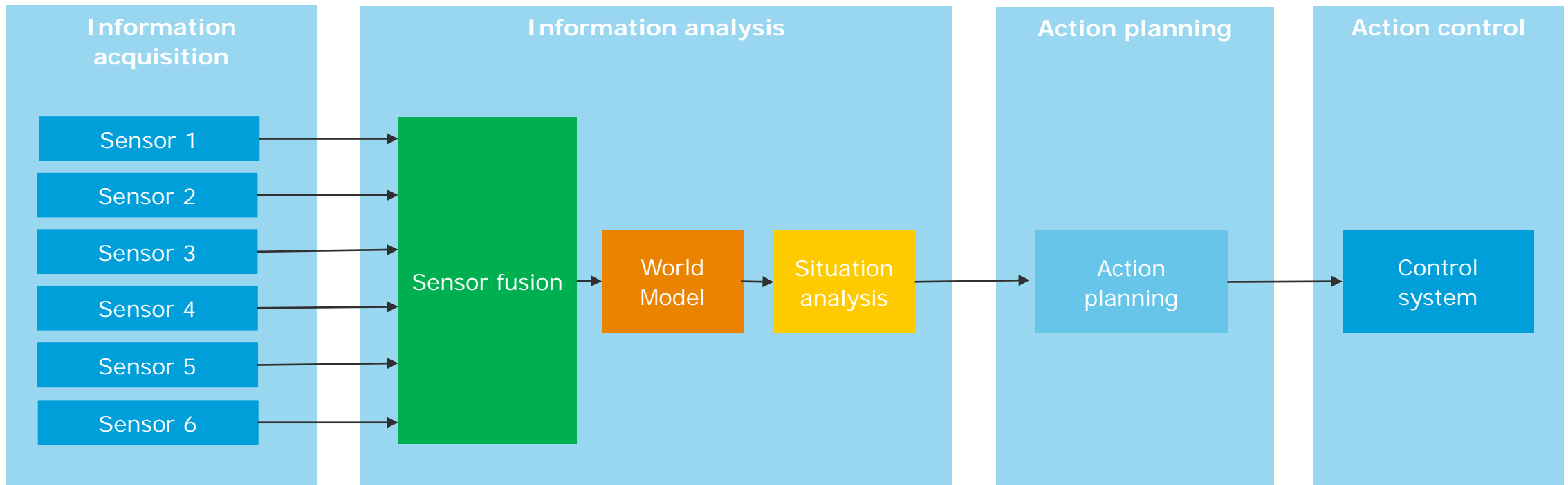
Action planning



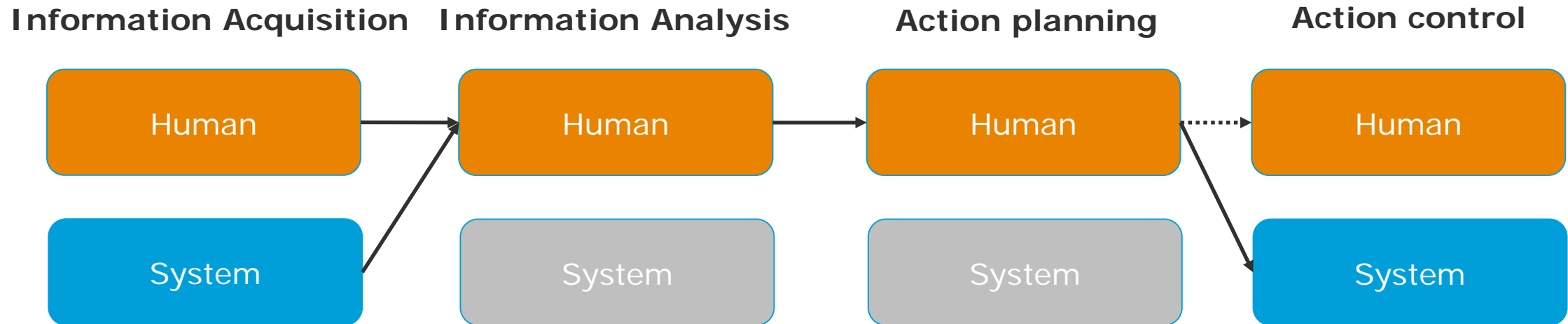
Action control



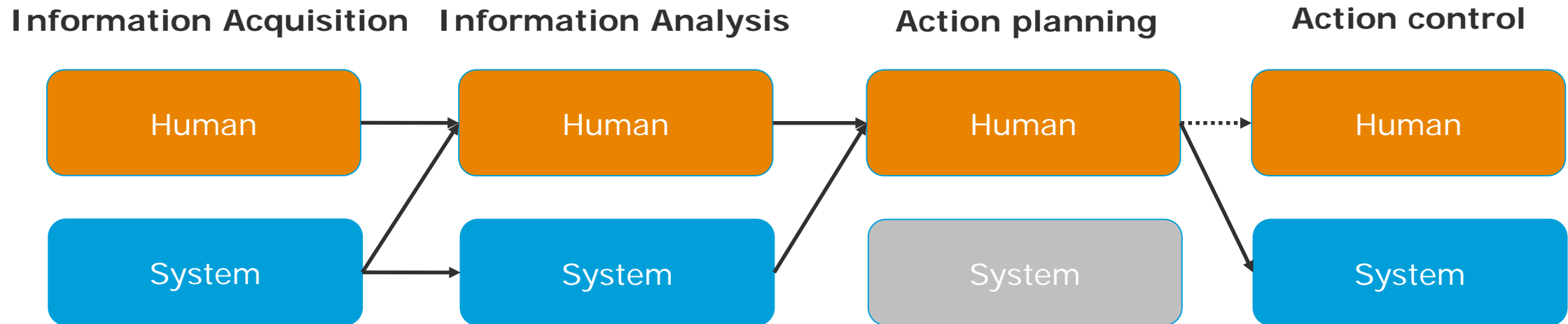
# Automated navigation



## Classic navigation (Human and machine)

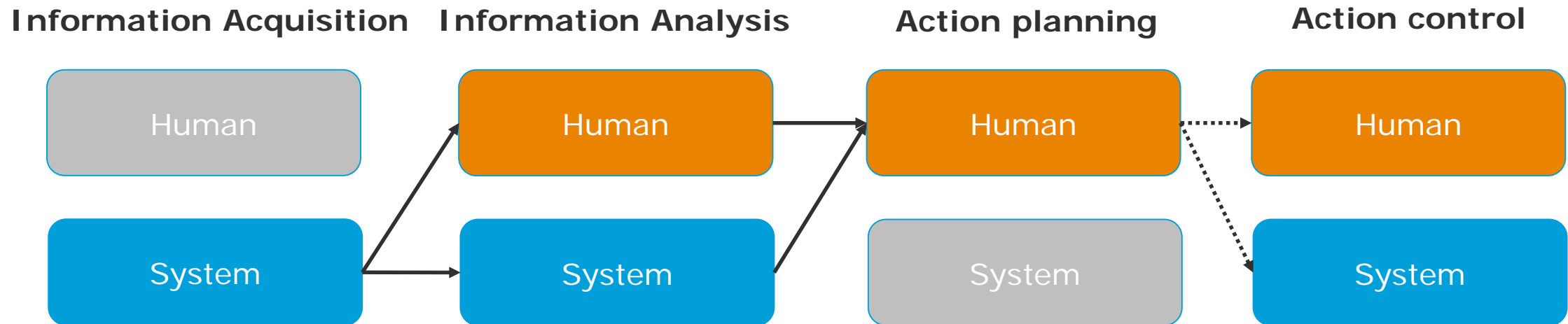


## Decision support (Look-out)

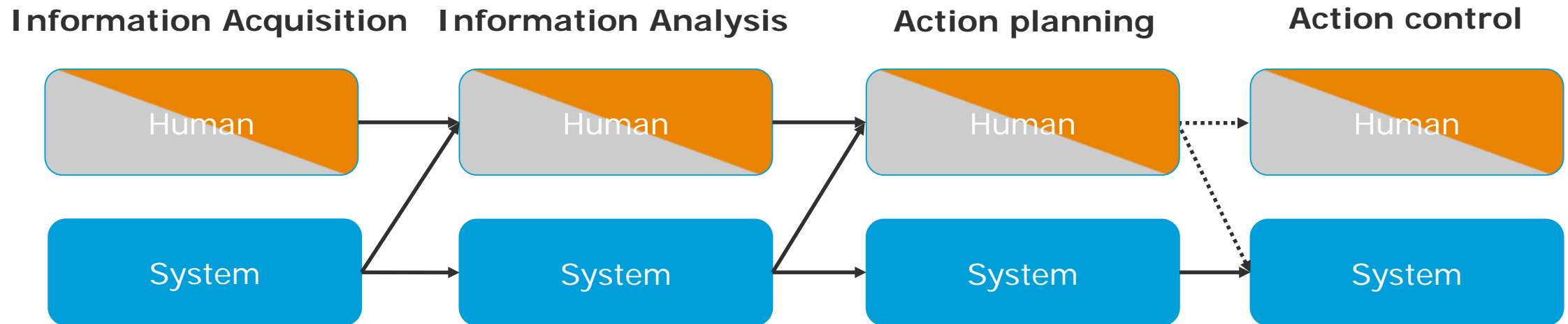




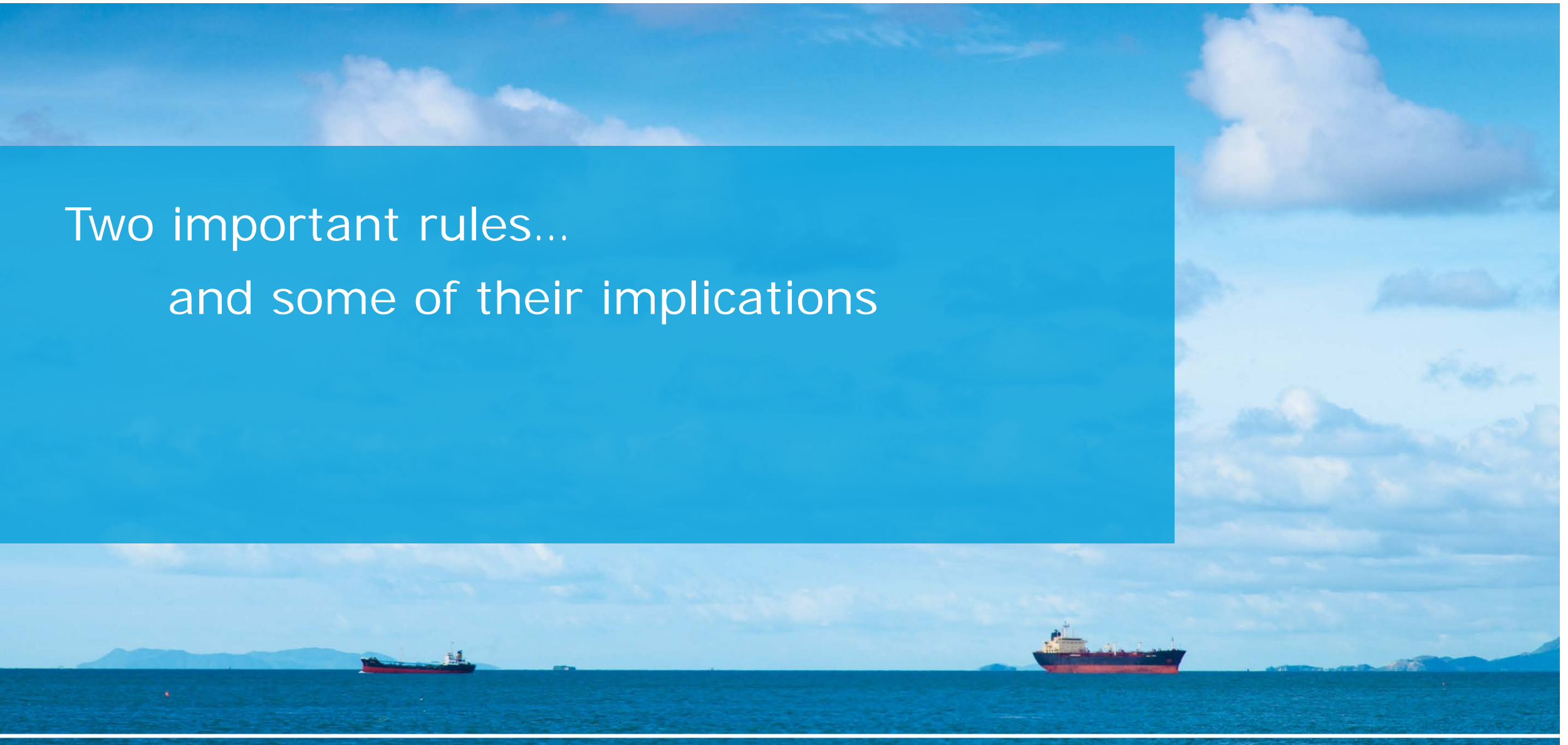
# Automated Look-out



## Periodically unmanned bridge



# Two important rules... and some of their implications



## Rule 8 – Action to avoid collision

### Extract from rule text:

- A) Any action to avoid collision [...] **shall be made in ample time** [...]
- B) Any alteration of course [...] **shall be large enough to be apparent to other vessels** [...]
- C) If there is sufficient sea-room, **alteration of course alone may be the most effective**
- E) If necessary to avoid collision [...], **a vessel shall slacken her speed**

### ■ “The Maneuvering rule”

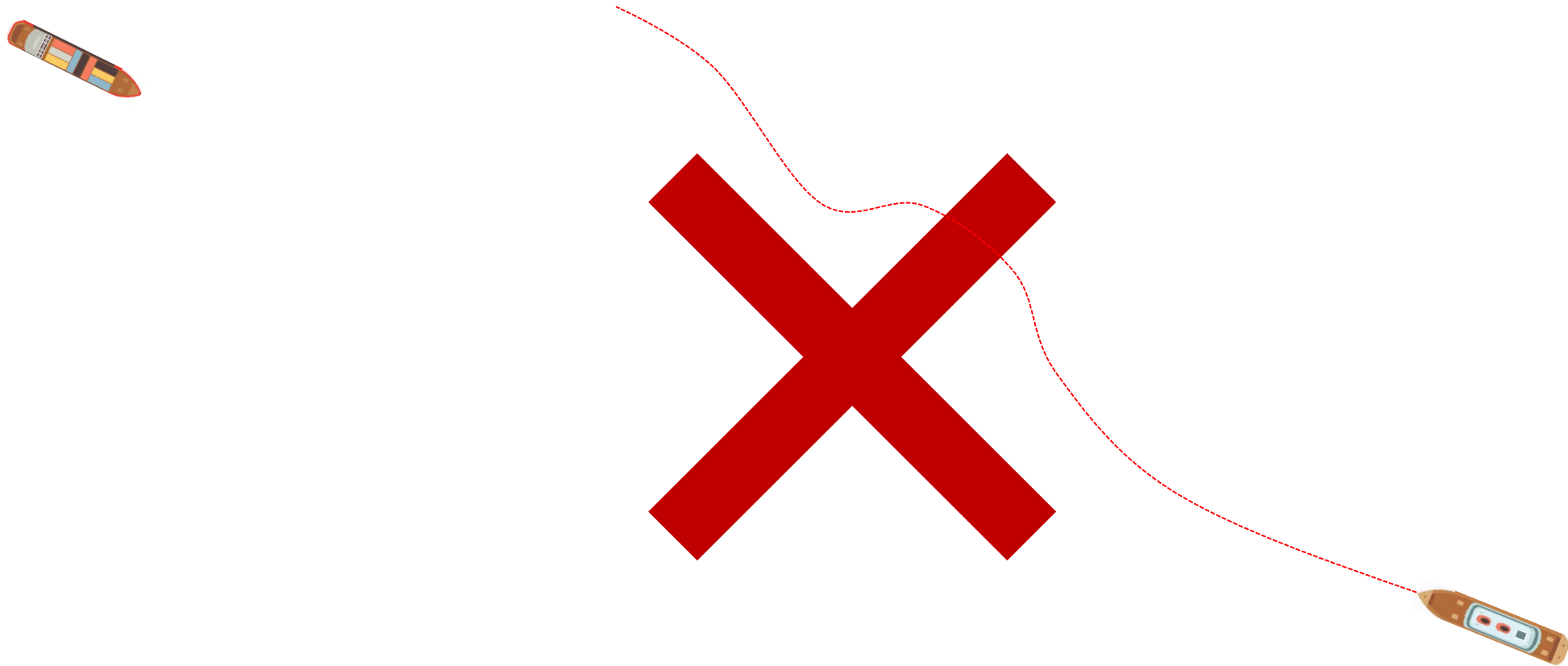
- Requirements to how actions to avoid collision should be performed

### ■ In short:

- Course change preferred, reduce speed if necessary
- Maneuvering is communication – be predictable
  - Perform maneuvers early
  - Use clear (apparent) maneuvers

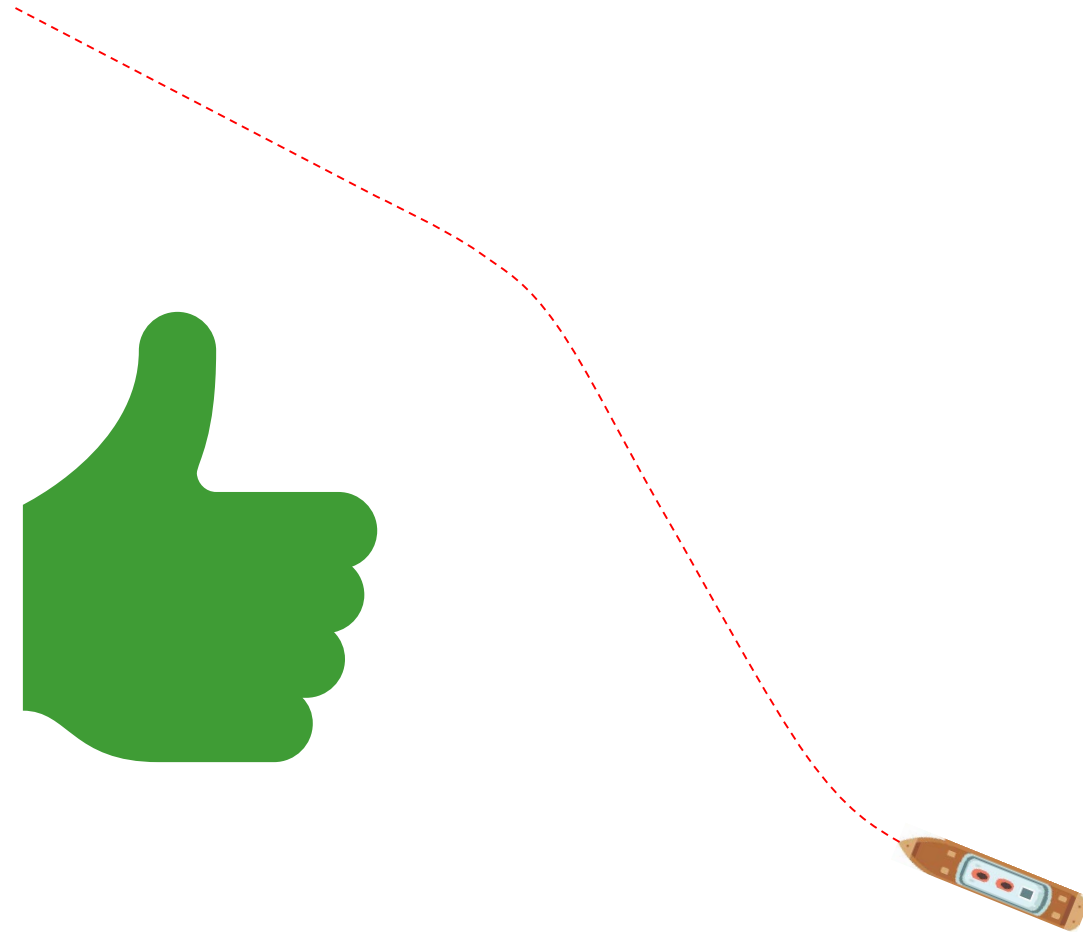
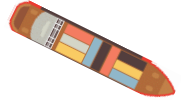
## Example situation: Rule 8 – Action to avoid collision

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## Example situation: Rule 8 – Action to avoid collision

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## Rule 2 – Responsibility

### Extract from rule text:

- *A) Nothing in these Rules shall exonerate any vessel, [...], from the consequences of any neglect to comply with these Rules or of the neglect of any precautions which may be required by the ordinary practice of seamen, [...].*
- *B) [...] due regard shall be had to all dangers of navigation and collision and to any special circumstances, [...], which may make a departure from these Rules necessary to avoid immediate danger.*

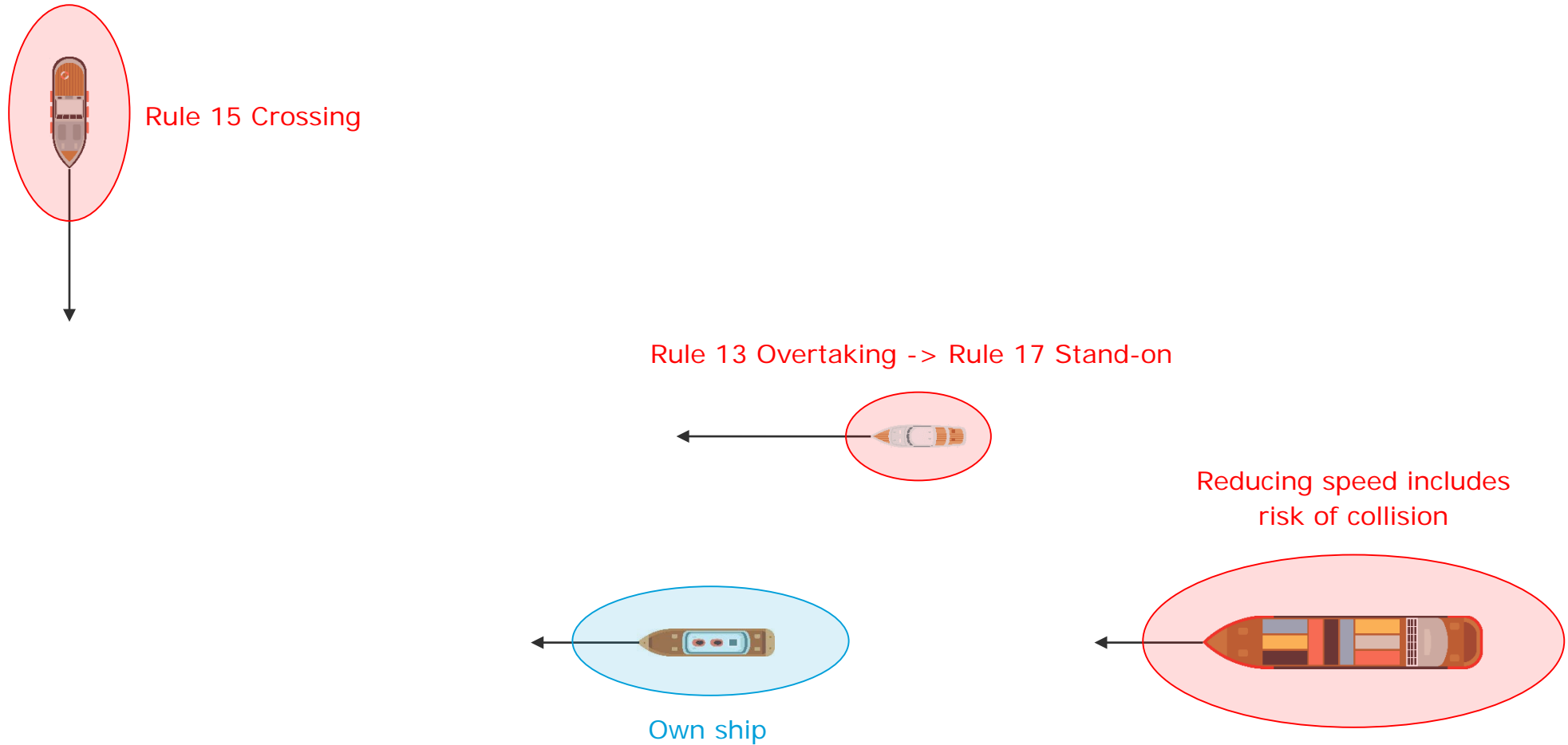
### ■ “The one rule – to rule them all”

- Perhaps the most misunderstood rule

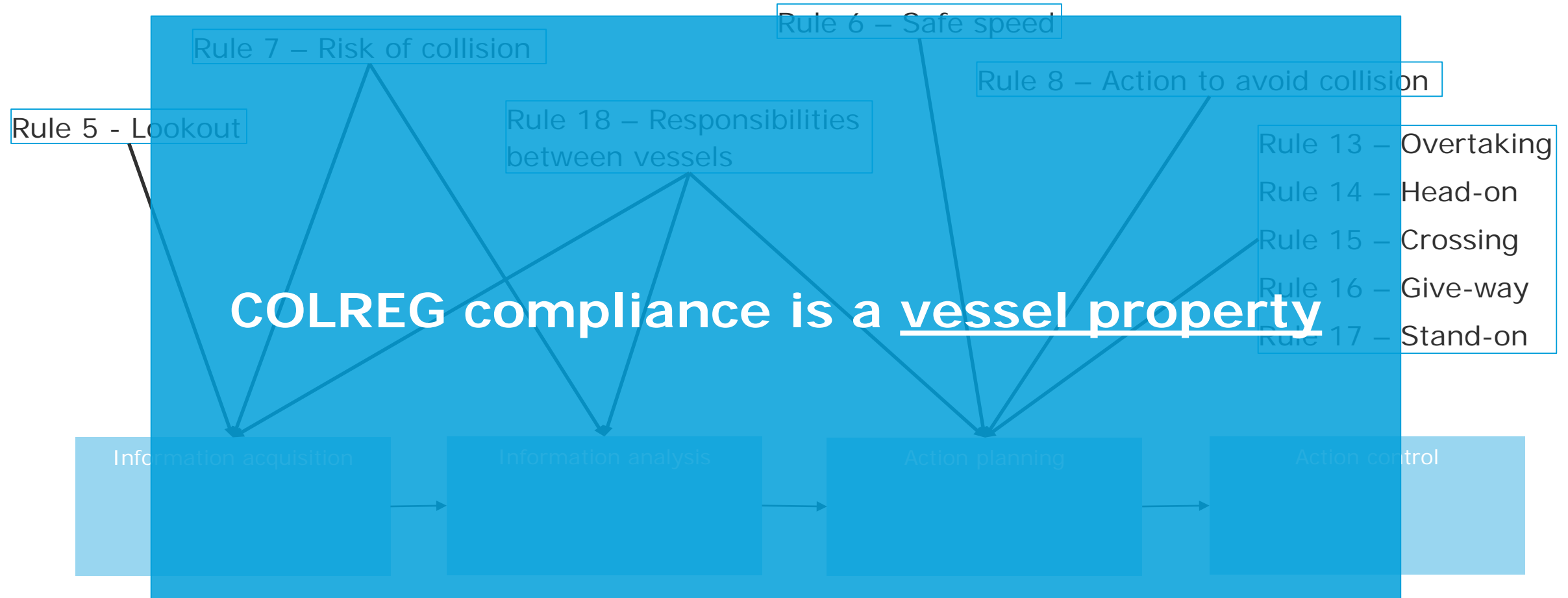
### ■ In short:

- Follow the rules and act safely
- Following the rules is not an excuse for collision
- Ability to follow the rules is not sufficient;
  - Must handle situations where the rules do not provide a safe solution

## Example situation: Rule 2 – Responsibility (conflicting rules)



## COLREG – Rules applies to different parts of the system



\* Not exhaustive

# Final words

- **COLREG**

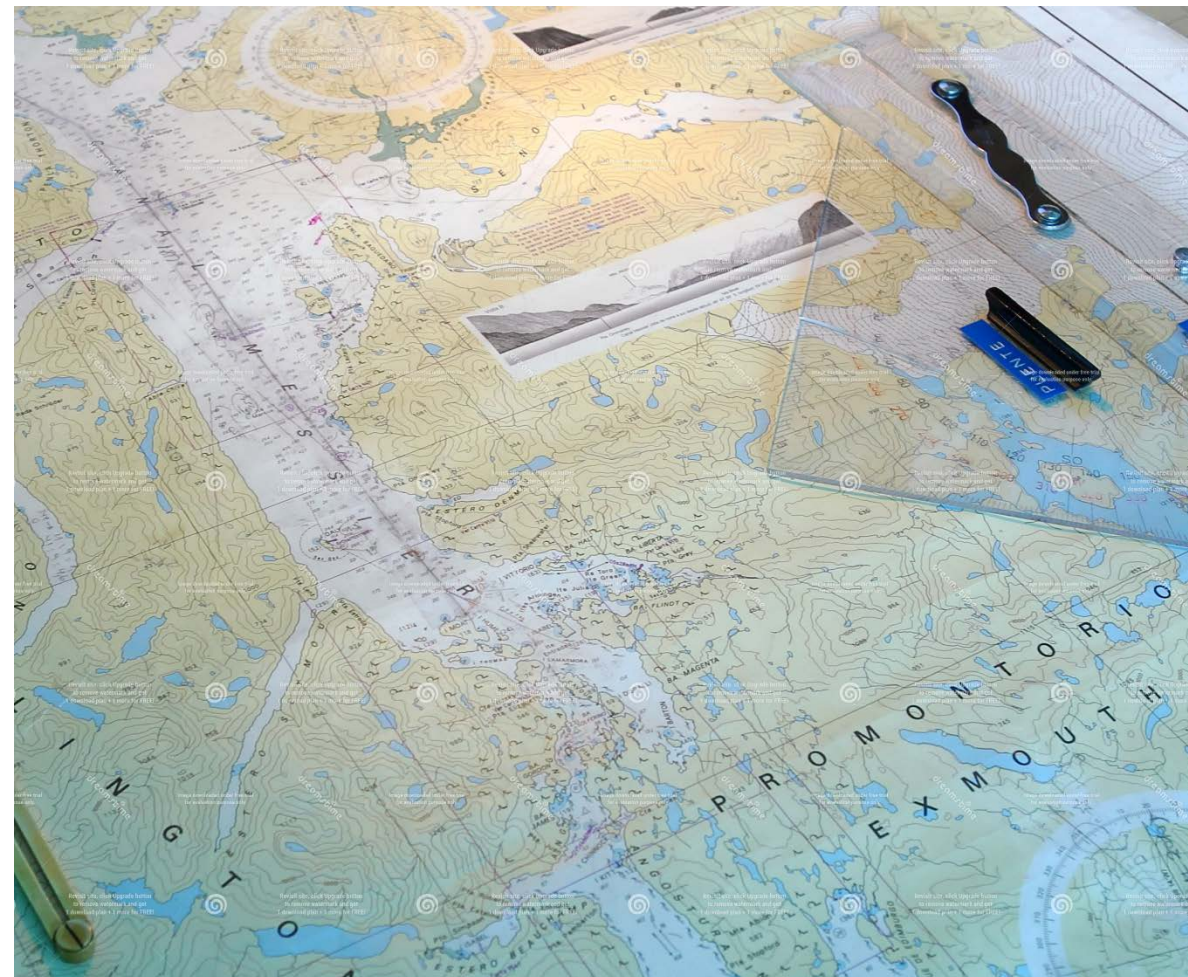
- Contains obligations for basic situations
- Is not a recipe for every possible situation

- **Contains many undefined terms**

- *Ample time, apparent, good seamanship ++*
- Requires situation-dependent interpretation

- **Requires “Navigator's common sense”**

- Principles of navigation
- Ability to predict scenarios
- Ability to evaluate risk
- Ability to plan several steps ahead







# Thank you for your attention

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