

Autonomous ships

View of the IMO Secretariat

Maritime Safety Division

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Levels of autonomy - definitions

Bureau Veritas

- Level 0: Human operated
- Level 1: Human directed
- Level 2: Human delegated
- Level 3: Human supervised
- Level 4: Fully autonomous

Norwegian Forum for Autonomous Ships (NFAS)

- .1 Decision support
- .2 Automatic bridge
- .3 Remote control
- .4 Automatic ship
- .5 Constrained autonomous
- .6 Fully autonomous

Source: document MSC 99/5/6 (Finland)

Levels of autonomy - definitions

Lloyd's Register

Level 0: No cyber access – no assessment – no descriptive note – included for information only.

Level 1: Manual cyber access – no assessment – no descriptive note – included for information only.

Level 2: Cyber access for autonomous/remote monitoring.

Level 3: Cyber access for autonomous/remote monitoring and control (onboard permission is required, onboard override is possible).

Level 4: Cyber access for autonomous/remote monitoring and control (onboard permission is not required, onboard override is possible).

Level 5: Cyber access for autonomous/remote monitoring and control (onboard permission is not required, onboard override is not possible).

Source: document MSC 99/5/6 (Finland)

Levels of autonomy - definitions

Ramboll and Core

- .1 M (Manual)
- .2 R (Remote)
- .3 RU (Remote, unmanned)
- .4 A (Autonomous)

Rolls-Royce

- Level 0 No autonomy
- Level 1 Partial autonomy
- Level 2 Conditional autonomy
- Level 3 High autonomy
- Level 4 Full autonomy

Source: document MSC 99/5/6 (Finland)

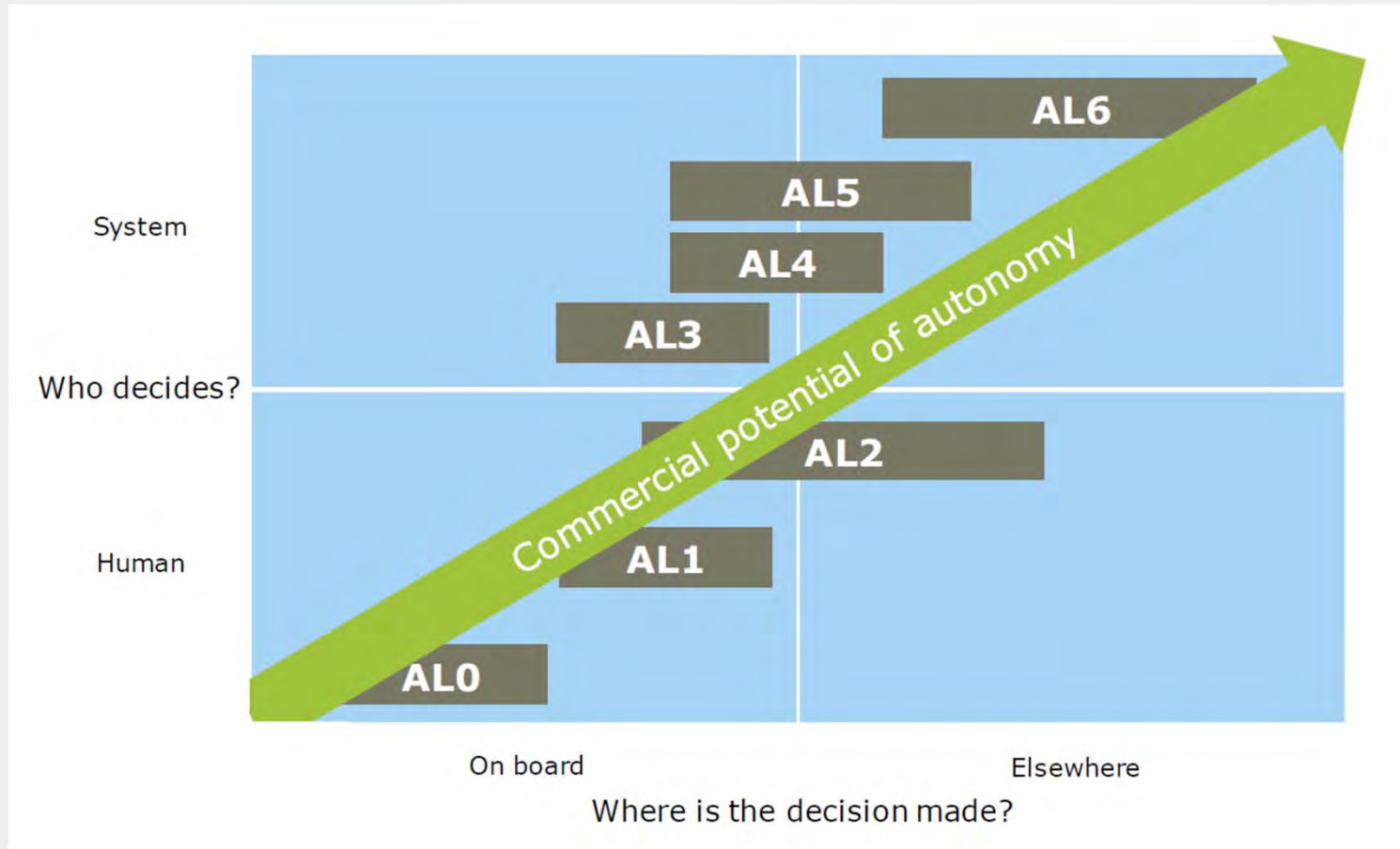
Levels of autonomy - definitions

UK Marine Industries Alliance

- Level 0 Manned.
- Level 1 Operated.
- Level 2 Directed.
- Level 3 Delegated.
- Level 4 Monitored.
- Level 5 Autonomous.

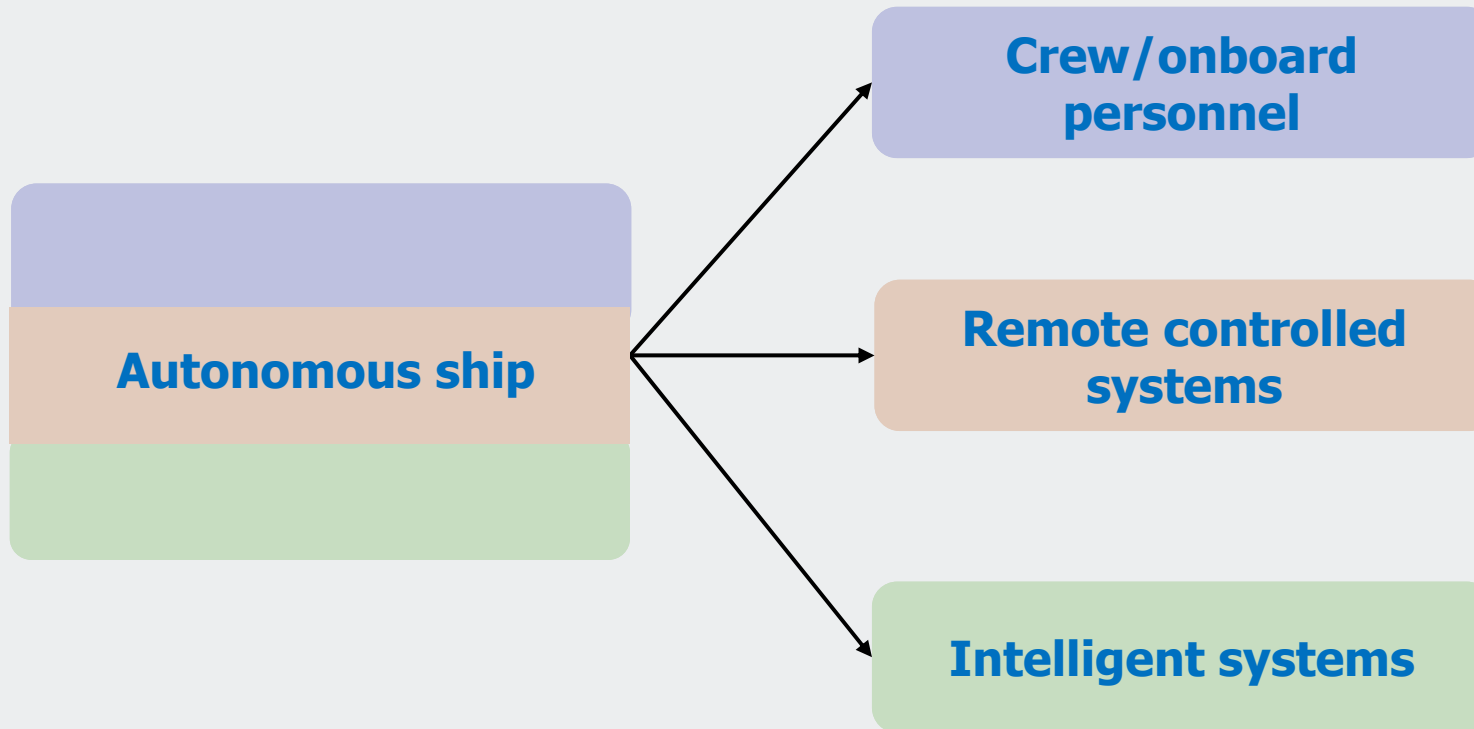
Source: document MSC 99/5/6 (Finland)

Levels of autonomy - overview

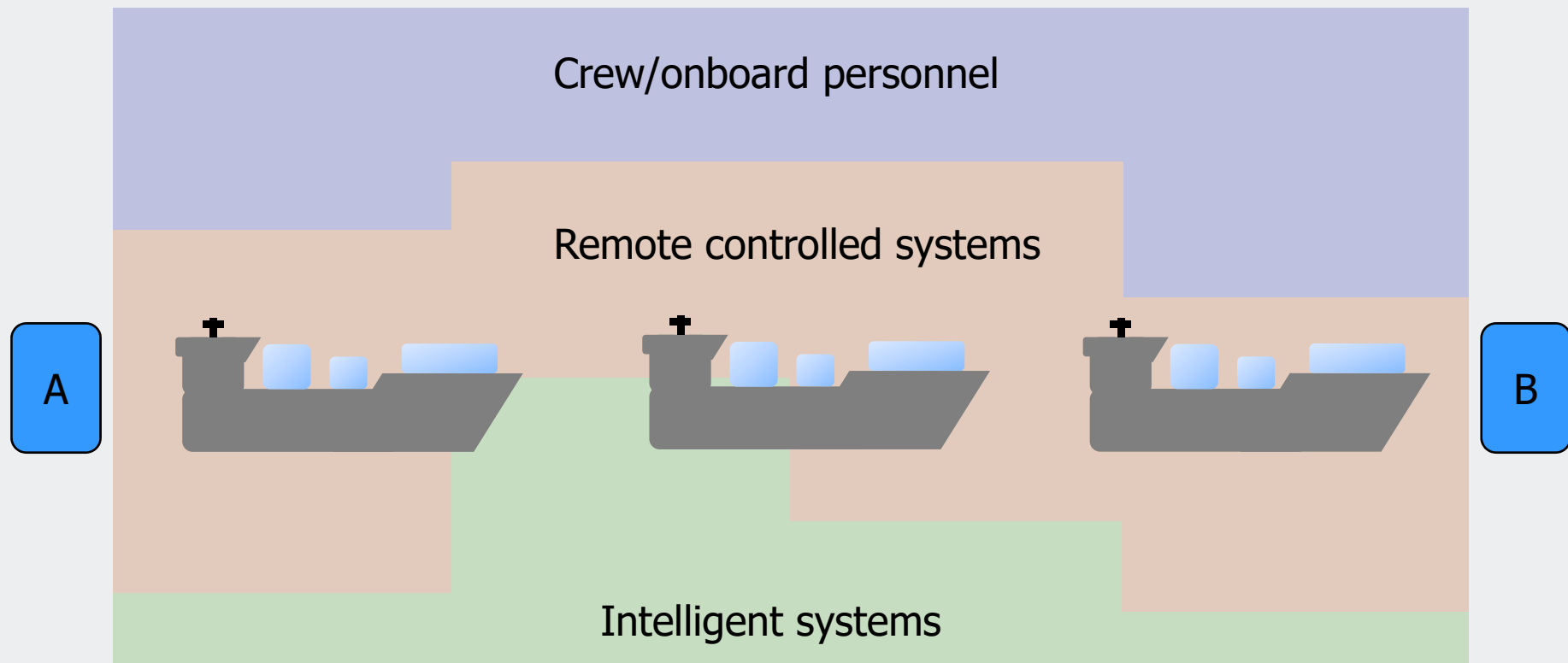


Source: document MSC 99/INF.3 (Denmark)

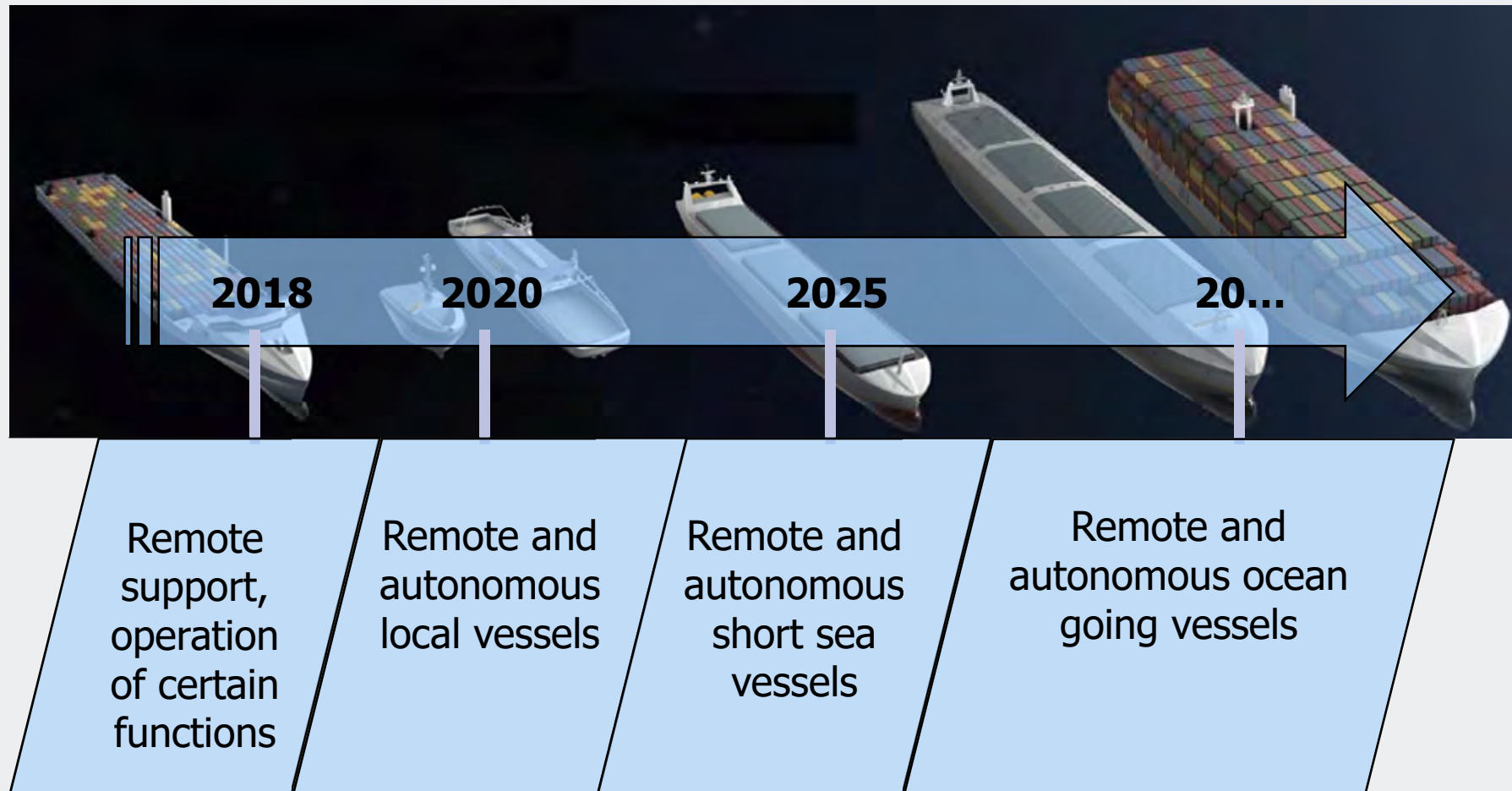
Levels of autonomy



Levels of autonomy



MASS – Industry vision



Source: Rolls-Royce

Regulatory scoping exercise

Objective: To respond proactively to the growth in the use of MASS in a timely manner, thereby continuing to promote safe, secure, environmentally sound, efficient and sustainable shipping.

MSC

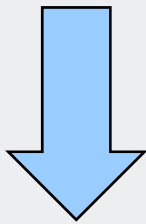
LEG

FAL

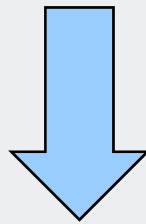
MEPC

Key aspects

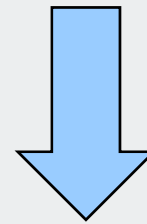
Technology developments
Remote controlled/intelligent systems



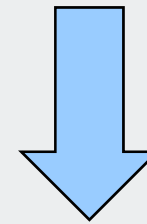
Safety



Security



Legal



Marine
environment

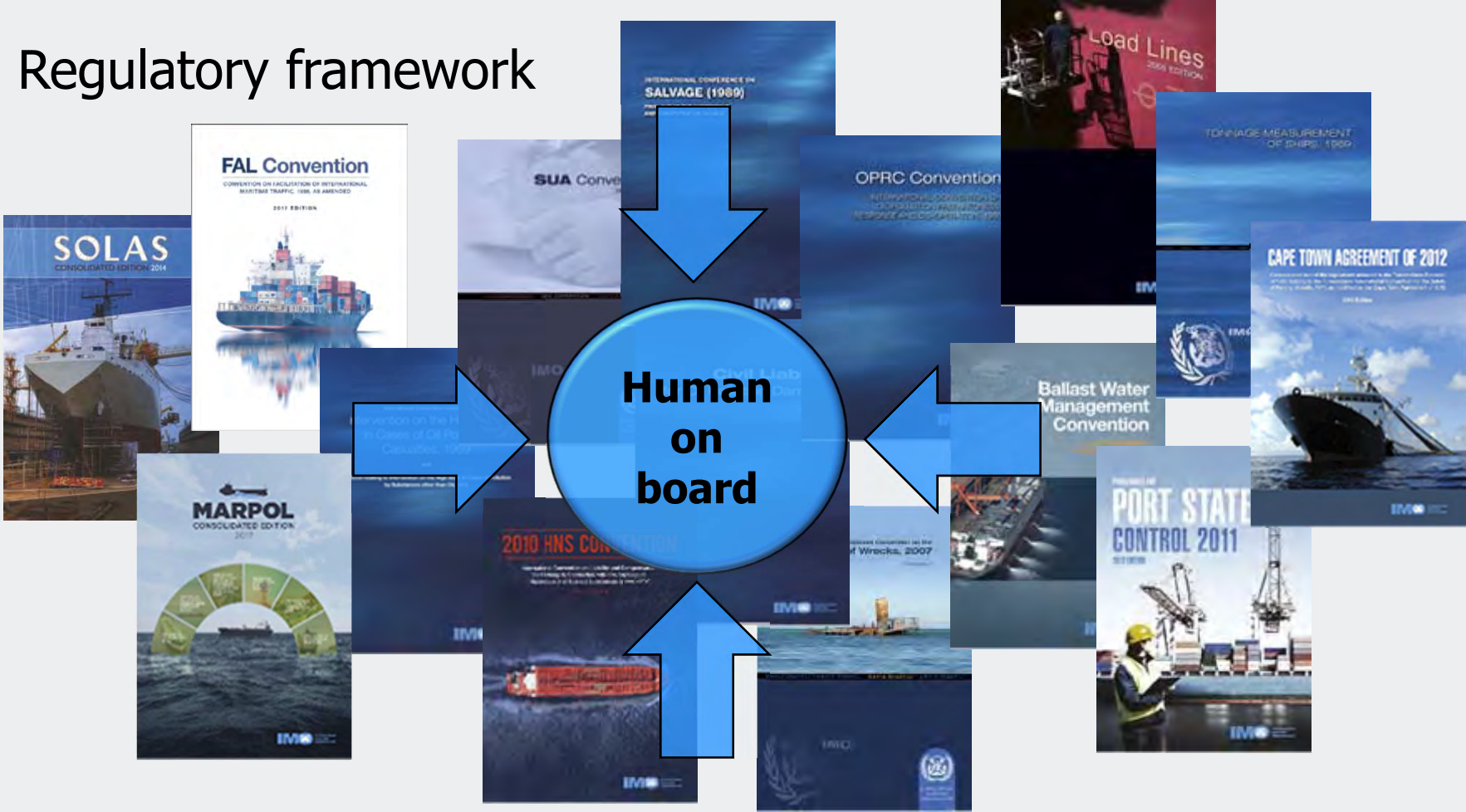
MASS taskforce

- Cross-divisional taskforce (MSC-MEPC-LEG-FAL)
- Created to:
 - Enhance communication and sharing of information
 - Assist with MASS developments
 - Provide advice and guidance as requested



Main challenge

Regulatory framework



Regulatory approach

- ❖ Amend existing regulations?
- ❖ Develop a new instrument?
- ❖ Combination of both?
- ❖ Need for guidelines and recommendations?

Framework of the regulatory scoping exercise

- Definitions and concepts
- Type and size of ships
- Instruments
- Methodology
- Deliverables
- Plan of work
- Intersessional arrangements
- Coordination mechanism



The future seafarer



- Training requirements
- Remote operator
- "IT" knowledge



Research projects

YARA



KONGSBERG

Re-Volt



MVA
REDEFINING SHIPPING

ROLLS ROYCE

DELTA MARIN

inmarsat
The mobile satellite company

DNV-GL

NIAPA

MUNIN

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