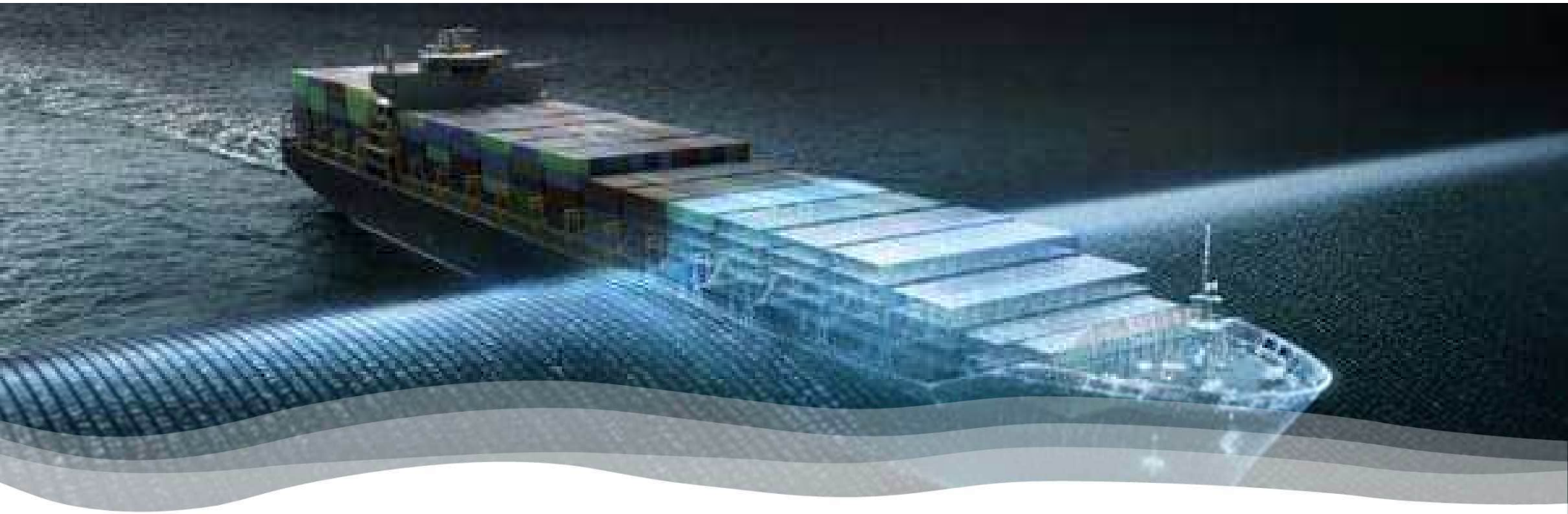


Making headway on the IMO MASS Code – Key principles of technology solutions for remote and autonomous shipping

June 30 , 2023

Capt. Marko Rahikainen
Director of Regulatory Affairs, One Sea Association

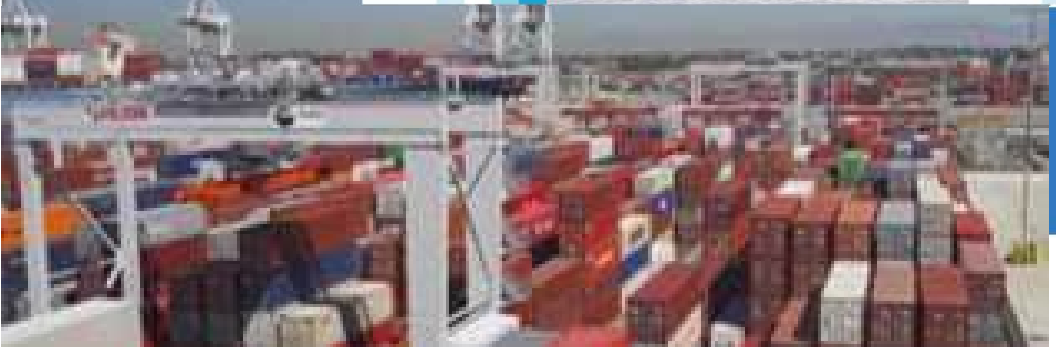
ONE SEA

MASS Maritime Autonomous Surface Ships and underwater ROV's

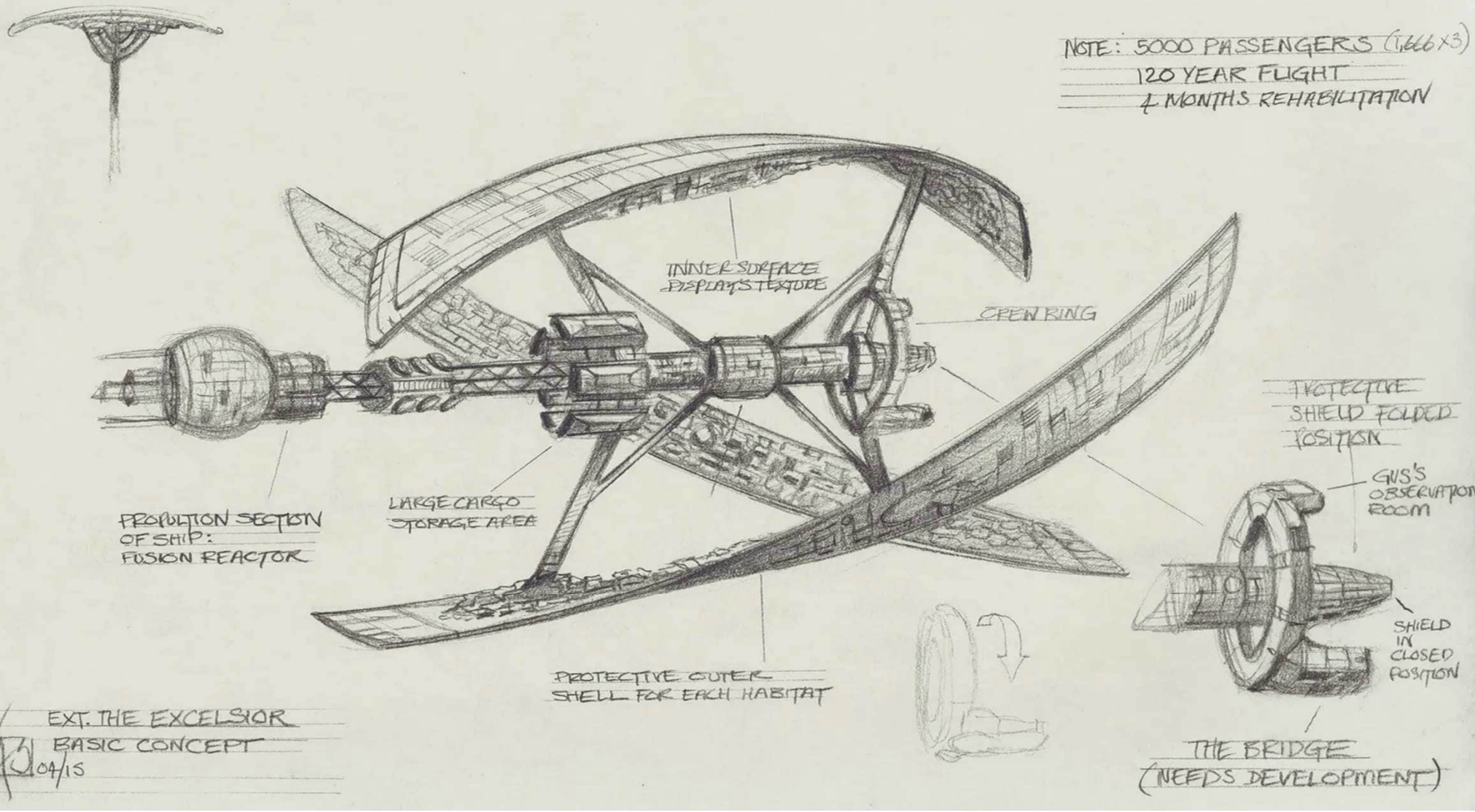
Automated maritime commuter services

Short Sea Shipping

Ocean going ships



DIGITALISATION, AUTOMATION and AUTONOMY in MARITIME TRAFFIC


NOTE: 5000 PASSENGERS (1,666 x 3)
120 YEAR FLIGHT
4 MONTHS REHABILITATION
INNER SURFACE DISPLAYS TEXTURE
CREW RING
PROTECTIVE SHIELD FOLDED POSITION
GUS'S OBSERVATION ROOM
PROPULSION SECTION OF SHIP: FUSION REACTOR
LARGE CARGO STORAGE AREA
SHIELD IN CLOSED POSITION
PROTECTIVE OUTER SHELL FOR EACH HABITAT
EXT. THE EXCELSIOR
BASIC CONCEPT
04/15
THE BRIDGE
(NEEDS DEVELOPMENT)

The Starship AVALON

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Goal of technology

Support human strengths with the capabilities of technology.

Combining the strengths of humans and technology

Human strengths

- Handling of uncertainty
- Applying knowledge and experience
- Creative problem-solving
- Human judgement

Machine strengths

- Continuity, objectivity
- Repeatability and consistency
- Very slow and very fast occurring events
- Machine does not get tired and does not forget

Role of technology

Technology doesn’t relive the master of any duties or responsibilities

From a technological point of view the location of the master is irrelevant

The role of a master

Master means the person having command of a ship

(UNCLOS art.94.4(b), STCW Ch I/1.3)

Masters' authority

The master of the ship takes or executes any decision which, in the master's professional judgement, is necessary

(SOLAS Ch V/34-1 and Ch XI-2/8)

Masters' discretion

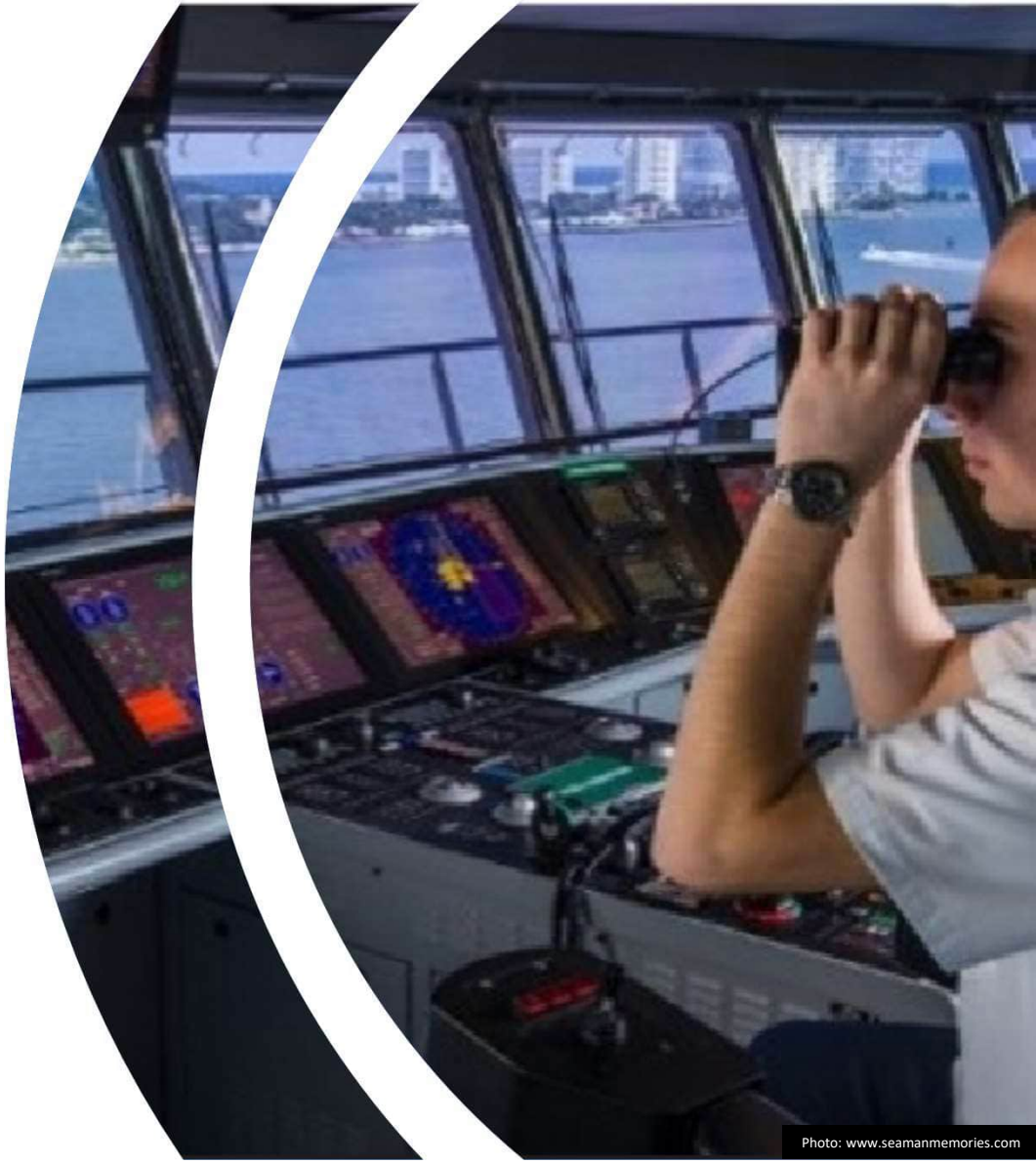
A task may be performed by a crewmember or a system

A task may be delegated, but the responsibility remains by the master to ensure it is properly executed

The role of a master

To ensure that watchkeeping arrangements and composition are adequate for maintaining a proper lookout, safe navigational or cargo watch.

UNCLOS art.94.3(a) and 4(b)
STCW Convention & Codes Ch VIII



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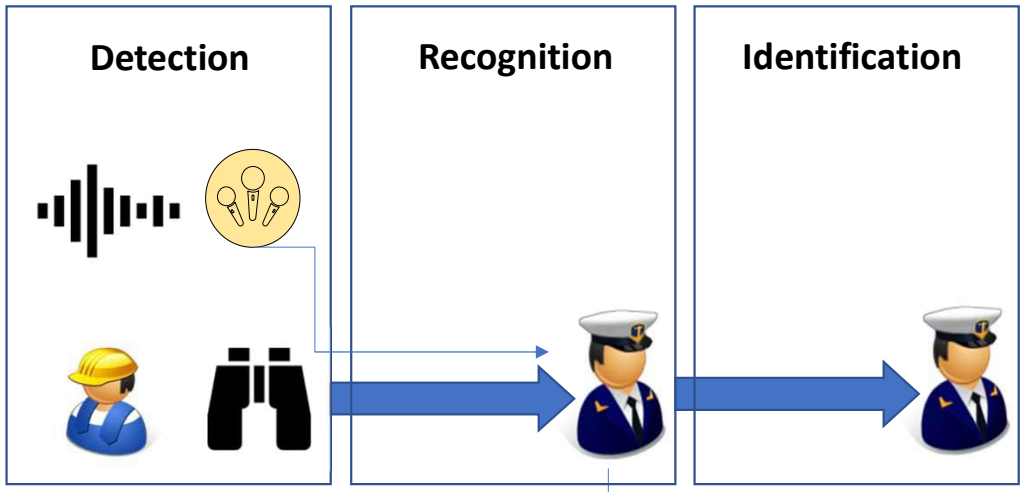
LOOKOUT

A proper lookout shall always maintain a continuous state of vigilance by sight and hearing, as well as by all other available means, with regard to any significant change in the operating environment.

Lookout
Rating - (Person designated as “lookout”)

STCW Convention - Regulation I/1.13 - Rating means a member of the ship’s crew other than the master or an officer.

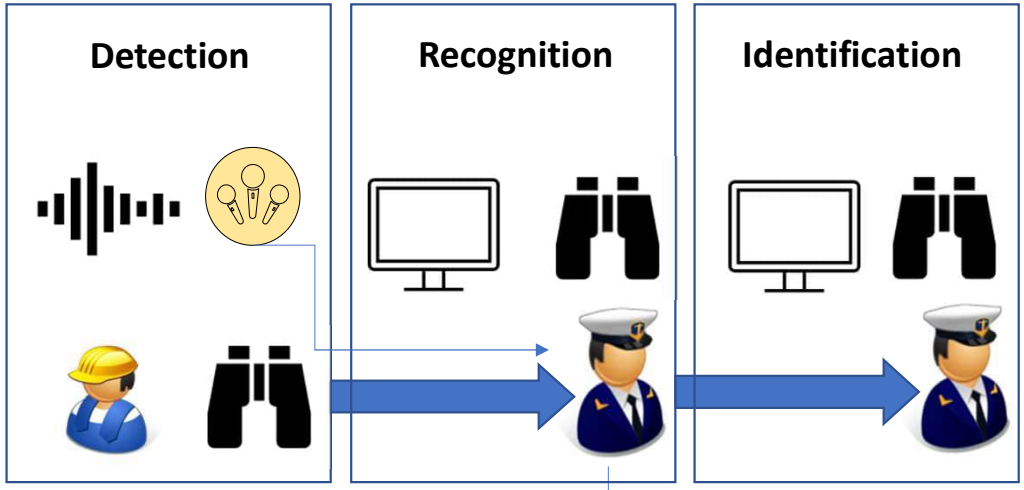


Keep a proper look-out by sight and hearing.
Responsibilities of a look-out, including reporting the approximate bearing of a sound signal, light or other object in degrees or points

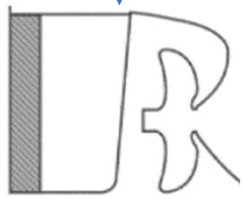
Detection: The rating shall provide discovery of an object and provide this information for OOW.

Lookout
The Officer of The Watch (OOW)

STCW Code Part 4-1 – 13 - The officer in charge of the navigational watch is the master's representative and is primarily responsible at all times for the safe navigation of the ship and for complying with COLREG.



OOW duty of look-out includes all available means (ECDIS, radar, AIS etc.) including sight and hearing to make a full appraisal of the situation and of the risk of collision.



Recognition and **Identification:** The OOW shall categorize the detected object and specify a unique identity of a recognized object needed to decide whether and how to react to the identified object.

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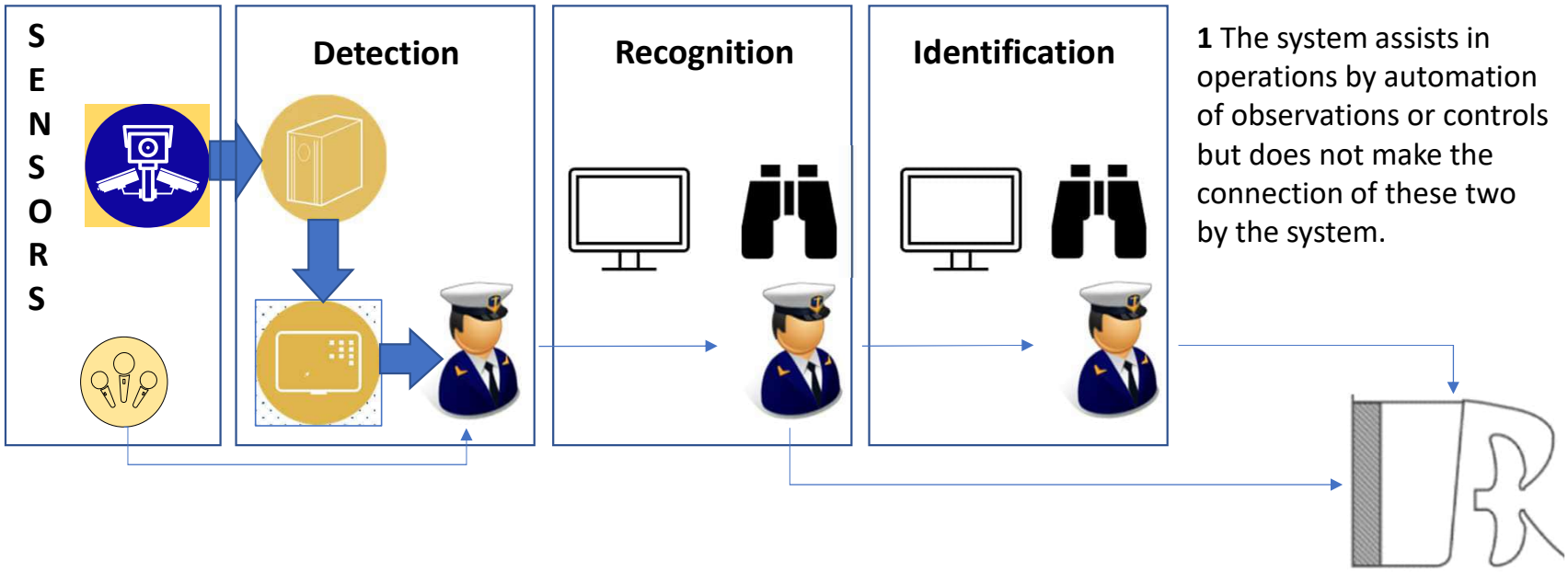
AUTOMATED
LOOKOUT

Improved safety, accuracy and reliability as well as improved seafarer working conditions and welfare.

Automated Lookout System (ALS)

Goal 1 Detection: The goal of the detection function is to provide discovery of an object and provide this information for the recognition function.

1 Assisted operations

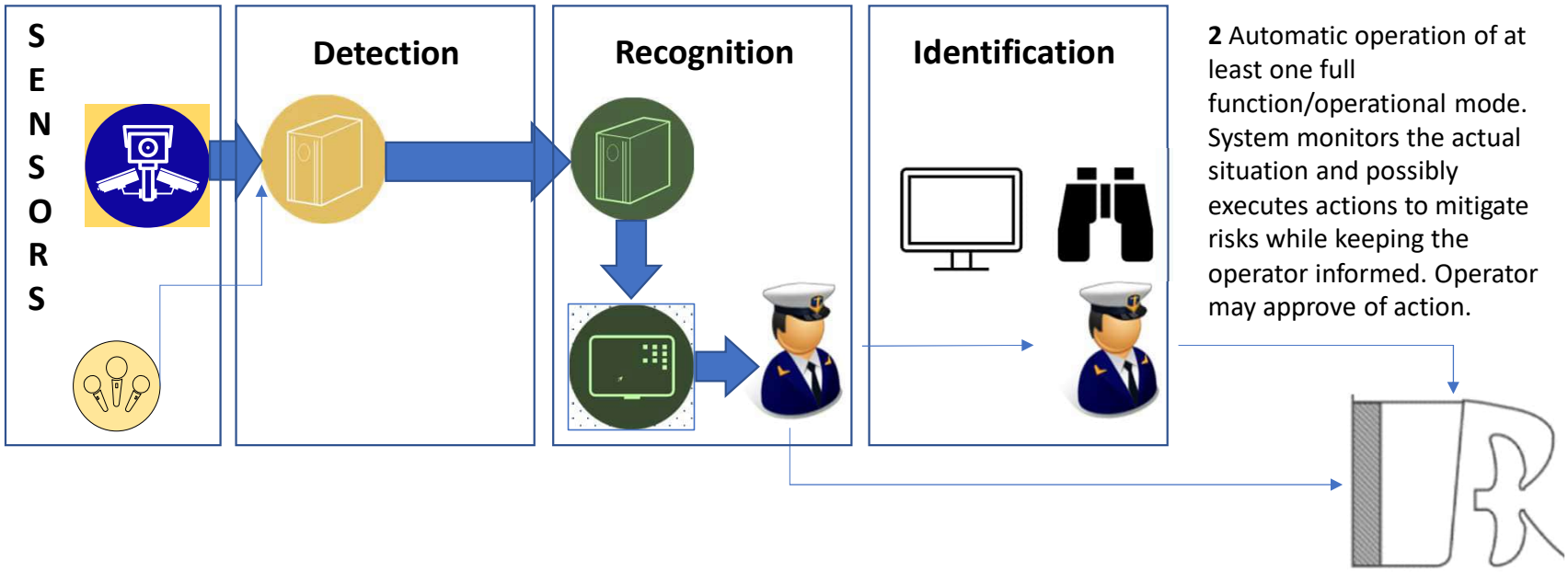


1 The system assists in operations by automation of observations or controls but does not make the connection of these two by the system.

Automated Lookout Systems (ALS)

Goal 2 Recognition: The recognition function shall categorize the detected object and provide this information to the identification function.

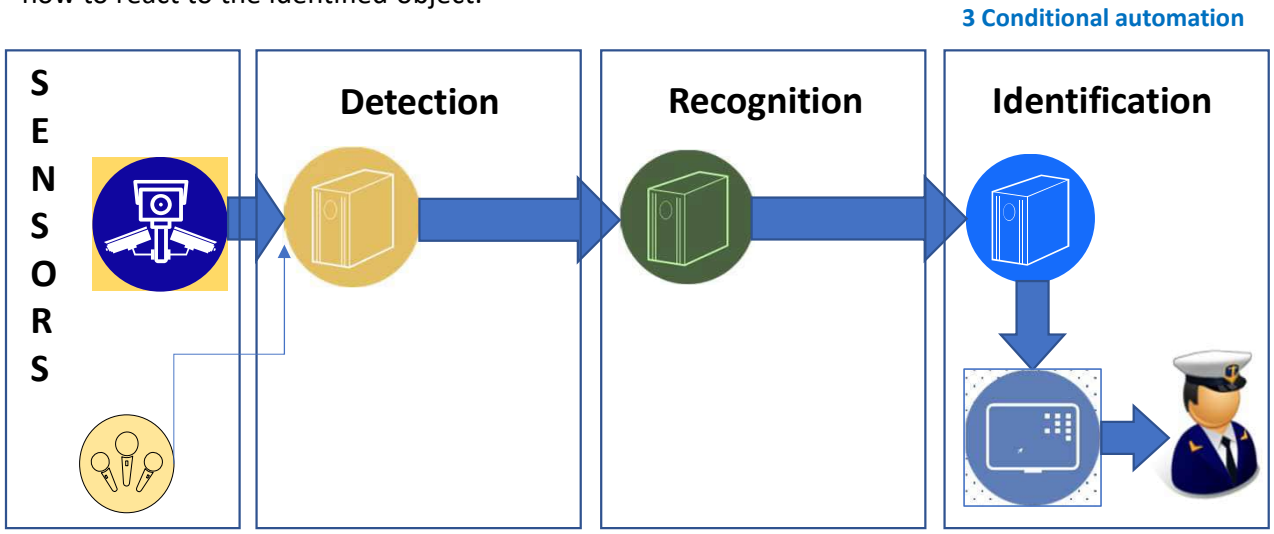
2 Partial automation



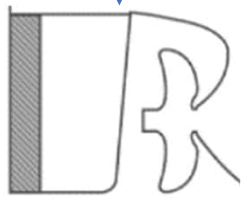
2 Automatic operation of at least one full function/operational mode. System monitors the actual situation and possibly executes actions to mitigate risks while keeping the operator informed. Operator may approve of action.

Automated Lookout Systems (ALS)

Goal 3 Identification: The identification function shall specify a unique identity of a recognized object needed to decide whether and how to react to the identified object.



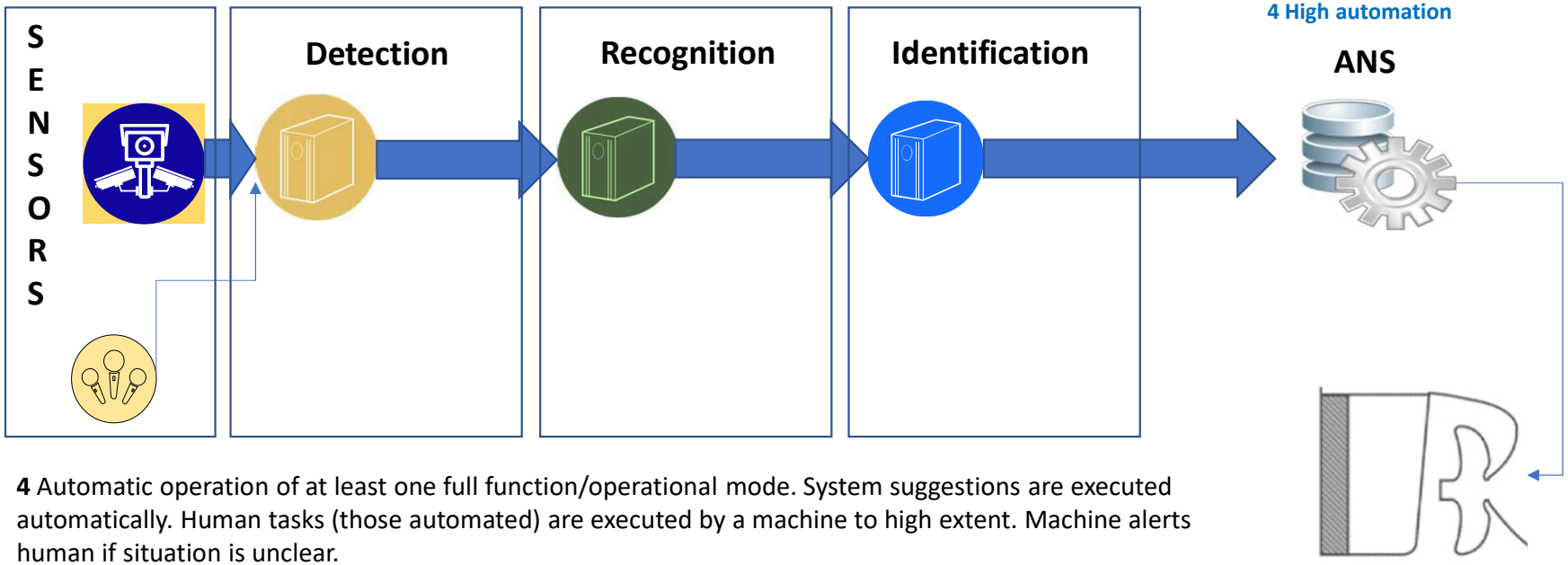
3 Automatic operation of at least one full function/operational mode. System suggestions are executed automatically. In good conditions human tasks could be replaced by a machine for a short (relative to the situation) period.



Automated Lookout System (ALS)

Goal - to continuously monitor the ship's surroundings, when the ship is underway or at anchor, to detect, recognize and identify any objects and lights on the surface of the sea in the ship's vicinity relevant to the safety of persons and the ship as well as other ships and vessels.

1 Assisted operations
2 Partial automation
3 Conditional automation
5 Autonomous
4 High automation

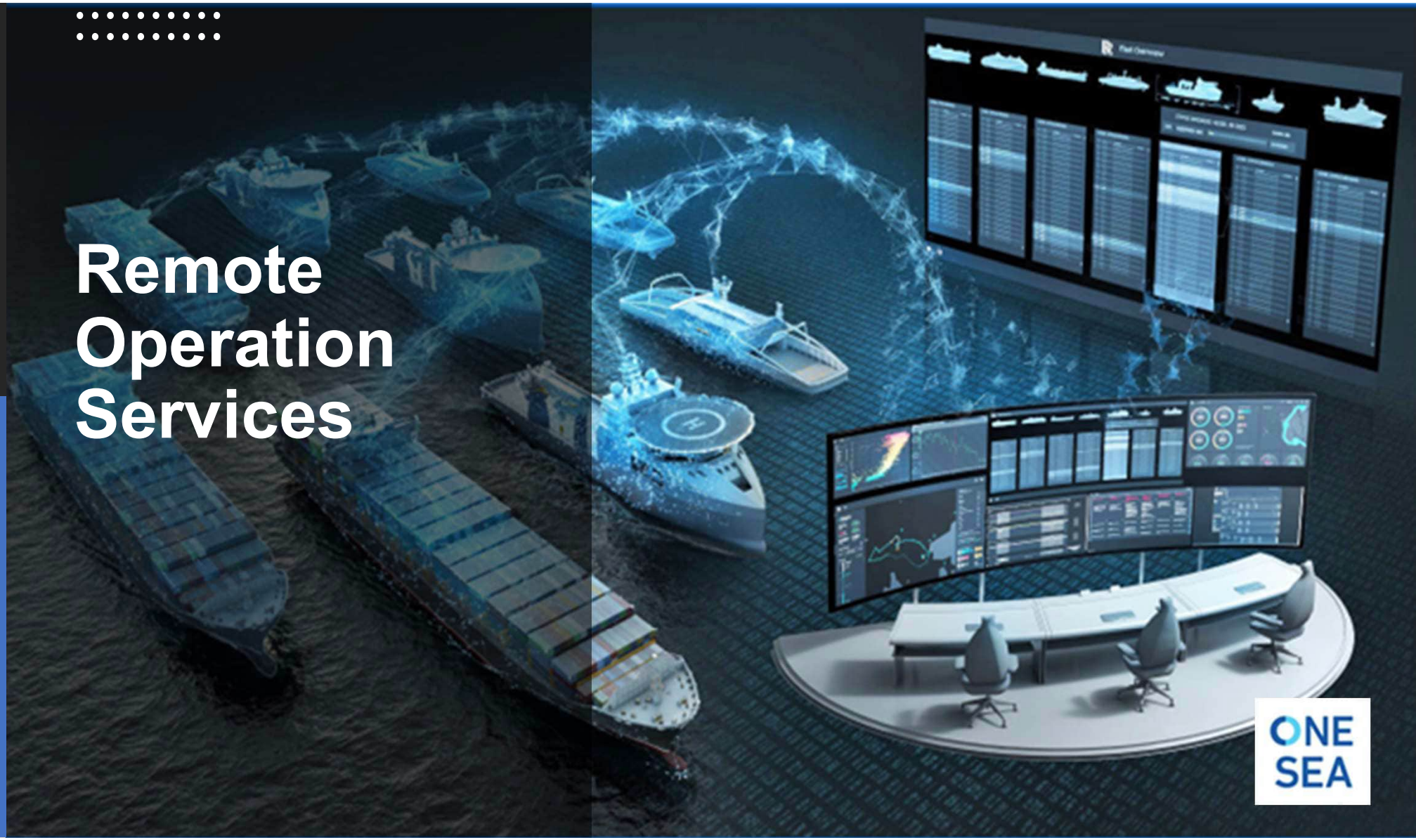


4 Automatic operation of at least one full function/operational mode. System suggestions are executed automatically. Human tasks (those automated) are executed by a machine to high extent. Machine alerts human if situation is unclear.

Or

5 Fully autonomous operation of at least one full function/operational mode. Human operator is not needed in those functions/operational models which are automated.

Remote Operation Services



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Level of
Remote Interaction

1. Monitoring
   read only information
2. Supervision
   high-level commands
3. Intervention
   detailed commands
4. Direct Control
   direct commands

ROC Safety

ROC Level 1 - not safety critical
ROC Level 2 - safety support
ROC Level 3 - safety critical

ISO 22237 - Data Centre
ISO 11064 - Control Centre
IEC 62443 - Cybersecurity

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Remote Master / Operator

Bridge Resource Management principles should be adhered to and obligations and tasks executed as on-board

Should not be considered as a seafarer

The MASS Code

Reduced regulatory uncertainty on the way towards productization of automated functions which take over tasks from officers and crew engaged in ship operation.

Technology solutions are critical for the maritime industry to address inefficiencies across the entire supply chain.

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Main principles

of the MASS Code under development should be a:

- complementarity,
- holistic,
- technology neutral instrument.

Application of MASS

“limit the development of the non-mandatory MASS Code to cargo ships”

Minimum 500 GT and maximum 12 passengers on international voyage

SOLAS Ch I/2 (e),(f),(g) and Ch I/3(a)(ii)

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Status of a MASS

A ship is a system of systems

A MASS ship or system
is a SOLAS ship and
is a ship among existing ships
and technologies

Crewing of MASS

The number of qualified and experienced seafarers necessary

Minimum crew is the flag States sovereign right and should remain under the jurisdiction of the flag State

(A.1047(27))

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Permit to operate

Bi-lateral or multilateral agreements should be the first step to establish international remote or autonomous maritime transport

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Clear and

common terminology

is urgently needed to!

- Facilitate the discussion,
- Ensure cross modality application,
- Create a seamless transport chain.

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Risk or Enabler

The use of [automated and/or remotely controlled] security systems *should not endanger the security of any persons* or property on board or of the ship.

"…systems shall not prevent the effective physical security…., pose a *risk to persons*,"

Risk or Enabler

The use of [automated and/or remotely controlled] security systems shall be designed to ensure the safety of any persons or property on board or of the ship.

"…systems shall ensure the physical security …., ensure the safety of persons,"

There is a

lack of focus

in the discussions in the role of a regulator

- IMO is the regulator ensuring SAFETY
- The industry is the developer and solution manufacturer

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