

The autonomy horizon

Space-to-Sea Solutions Event

Centro Congressi Stazione Marittima
Naples, Italy



Capt. Marko Rahikainen
Director of Regulatory Affairs
One Sea Association

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In cooperation with:



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*“One Sea's **mission** is to unite a diverse community of stakeholders to form an ecosystem to address challenges and to drive the transition towards **higher utilisation of** digitalisation, evolving automation, and **connectivity capabilities**.”*



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AUTONOMOUS VESSEL CONCEPTS

The **ONE SEA** smart, safe and sustainable maritime operations

SHORT-SEA CARGO VESSEL Autonomous short-sea cargo transportation  • Efficient & cost-effective • Reduced emissions	OFFSHORE SUPPORT VESSEL Autonomous operations for offshore energy & services  • Safe remote operations • 24/7 availability	SURVEY & MAPPING VESSEL High-precision data collection without on-board crew  • Accurate data acquisition • Reduced operational risk	AUTONOMOUS TUG Remote & autonomous harbor assistance  • Precise maneuvering • Enhanced port safety
AUTONOMOUS FERRY Sustainable & efficient passenger transport  • Zero-emission ready • Improved passenger experience	OCEAN CLEANUP VESSEL Autonomous ocean litter collection & monitoring  • Environmental protection • Data-driven insights	UNCREWED UNDERWATER VEHICLE (UUV) Autonomous subsea inspection, monitoring & surveying  • Deep & dangerous operations • High-resolution data	REMOTE OPERATIONS CENTER Monitor, control and optimize fleets from anywhere in the world 

ENABLING AUTONOMY

- SENSOR SUITE**
360° awareness & object detection
- AI & MACHINE LEARNING**
Perception, decision-making & adaptive learning
- SECURE CONNECTIVITY**
Reliable communication & remote data link
- CYBERSECURITY**
Protected systems & data integrity
- MODULAR & SCALABLE**
Flexible design for diverse missions

Autonomous vessels. Smart operations. Sustainable future.

Image generated with AI

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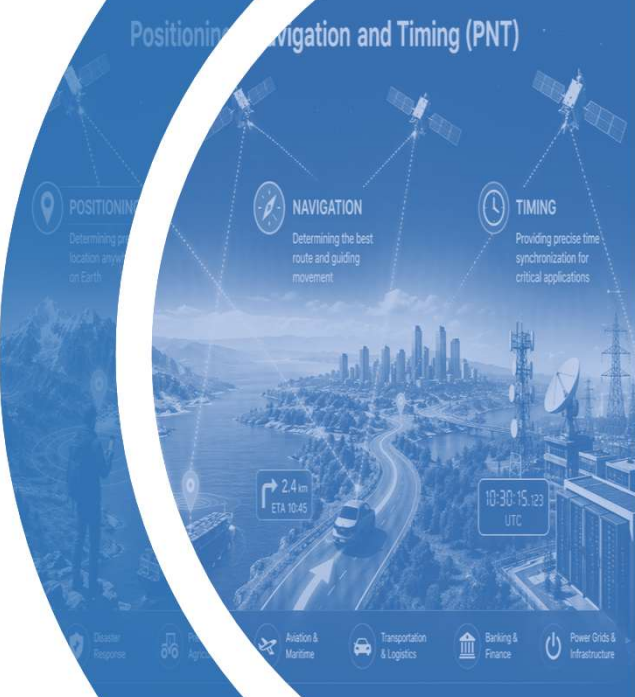
POSITIONING , NAVIGATION AND TIMING (PNT)

Navigation support

Space-based services are expected to enable persistent **connectivity** and **positioning** for unmanned ships and vessels operating **beyond terrestrial network coverage**.

Positioning, Navigation and Timing (PNT)

- POSITIONING**
Determining precise location anywhere on Earth
- NAVIGATION**
Determining the best route and guiding movement
- TIMING**
Providing precise time synchronization for critical applications



Disaster Response Agriculture Aviation & Maritime Transportation & Logistics Banking & Finance Power Grids & Infrastructure

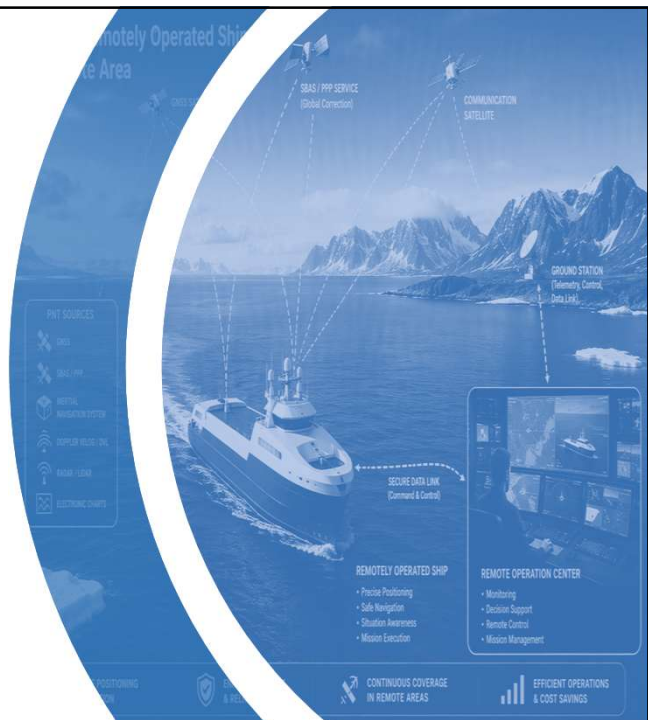
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POSITIONING , NAVIGATION AND TIMING (PNT)

Global communications

For unmanned remotely attended operations, Space-based services are a fundamental enabler to transform many functions traditionally performed by onboard personnel.



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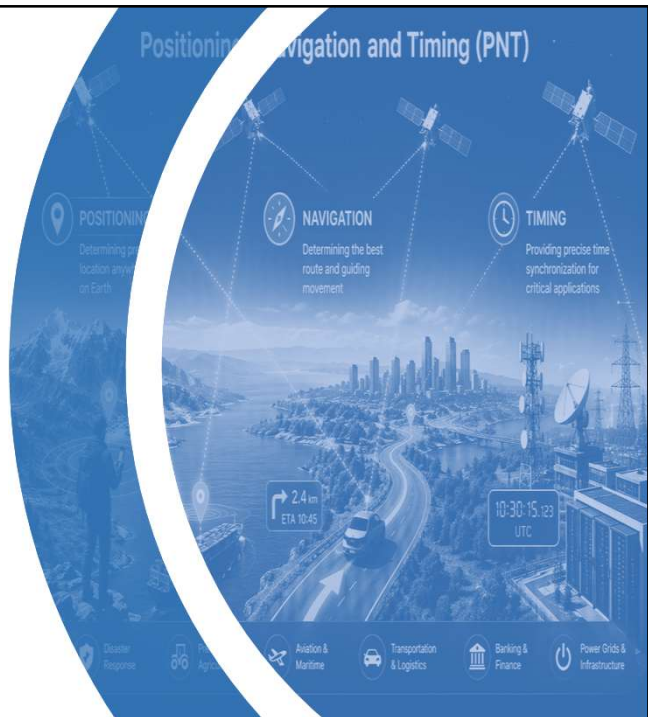


DATA REFRESHING RATE

Refreshing rate need is different for **static data** and **dynamic data**.

Static Data would require a very infrequent or low update rate.

Dynamic Data should be examined in informative and safety critical categories.



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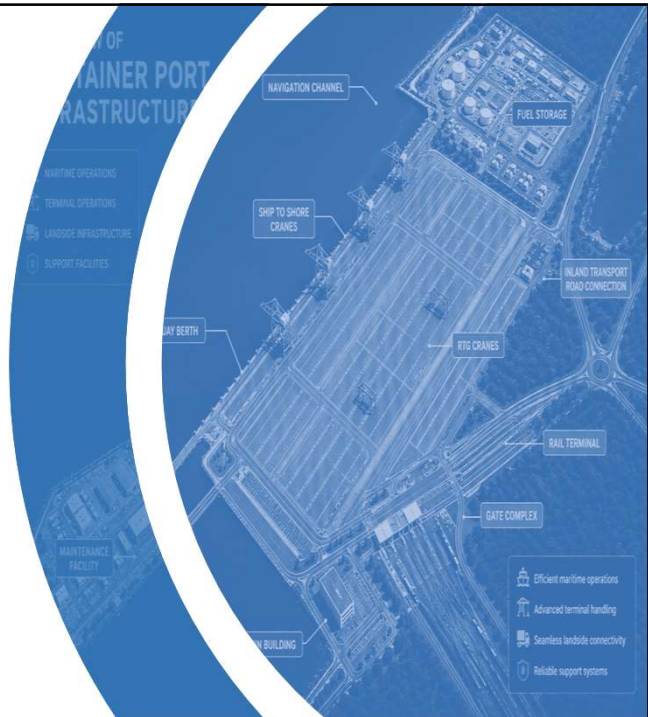


DATA REFRESHING RATE

STATIC DATA

Mainly geographical and infrastructure positions and measures.

Low refreshing rate.



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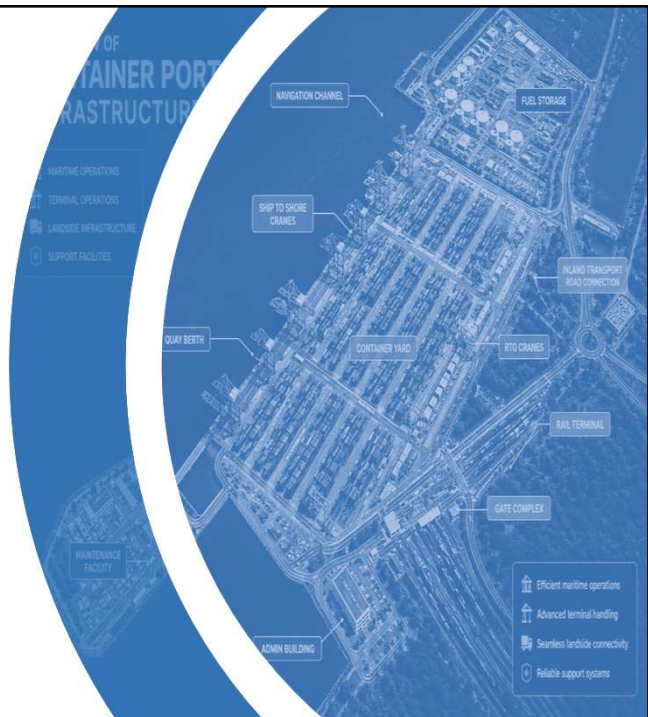


DATA REFRESHING RATE

DYNAMIC DATA - Info

Informative data on changes in the environment would require more frequent updates or when requested.

Medium refreshing rate.



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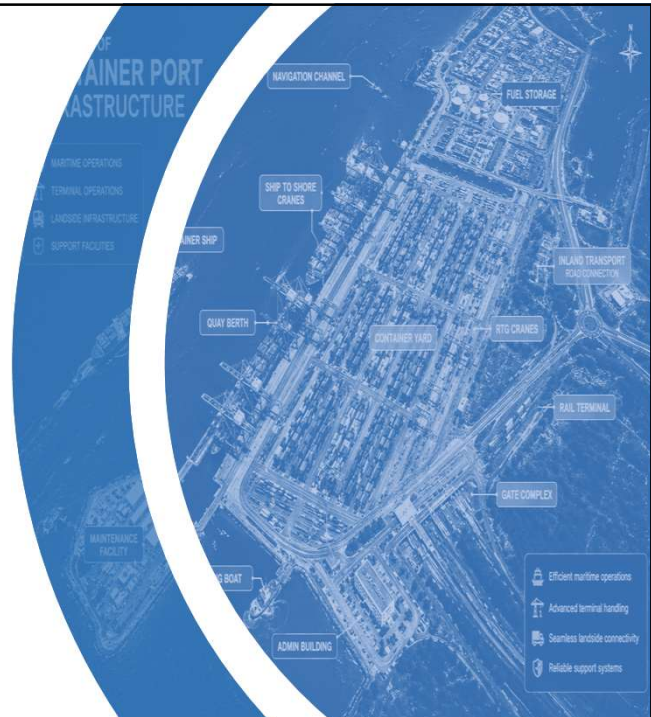


DATA REFRESHING RATE

DYNAMIC DATA - Critical

Safety Critical Data regarding traffic and environmental hazards, would need a frequent update rate.

High refreshing rate depending on the risk and hazard invoked.



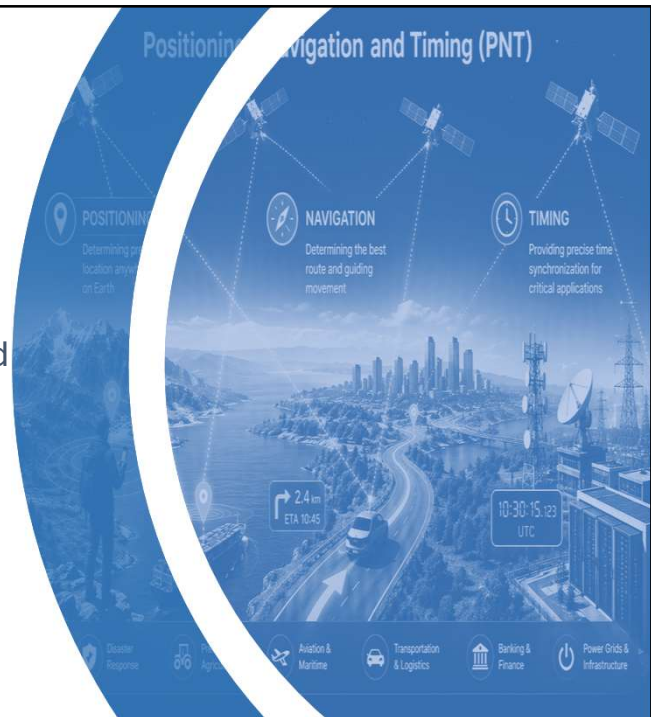
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POSITIONING , NAVIGATION AND TIMING (PNT)

Global communications

Space-based services are expected to enable persistent **situational awareness** required for safe remote oversight and intervention of unmanned ships and vessels operating **beyond terrestrial network coverage**.



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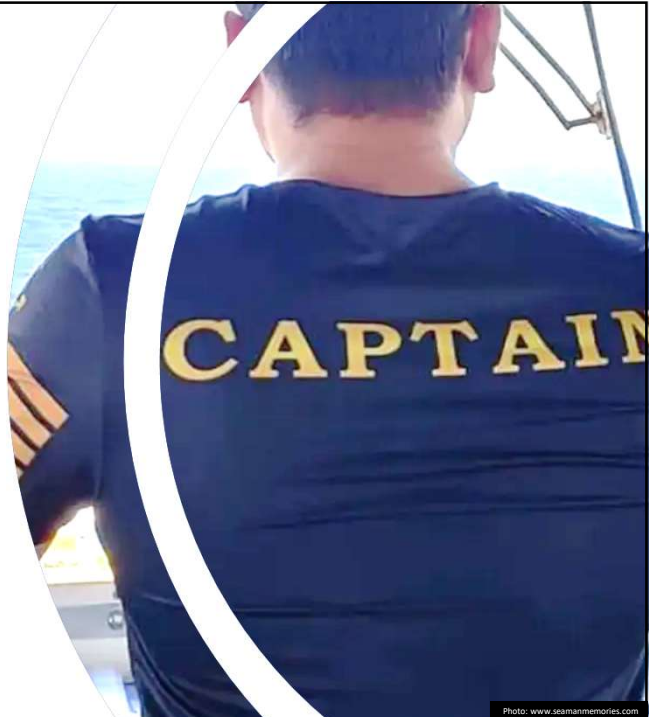


HUMAN OVERSIGHT AND CONTROL

Remote intervention

.....the master should have the means to intervene when necessary.

Master means the person having command of a ship
(UNCLOS art.94.4(b), STCW Ch I/1.3)



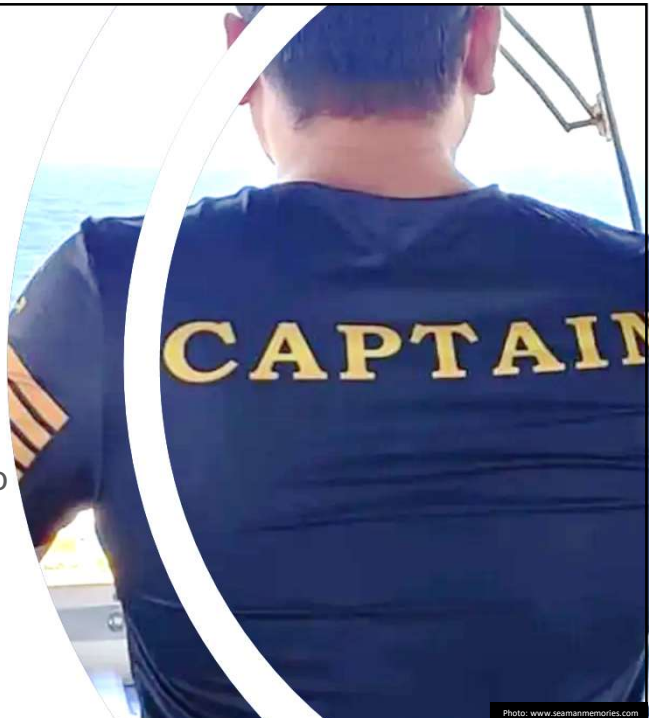
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HUMAN OVERSIGHT AND CONTROL

Situational awareness

Remote operators should be **provided with ample time and sufficient information** to be able to establish situational awareness.



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HUMAN OVERSIGHT AND CONTROL

Tracking and compliance

Remote operators should **always be able** to exercise human **oversight** and **direct or supervisory control of all functions** and to intervene and/or override the system **without risk to the outcome of the task.**

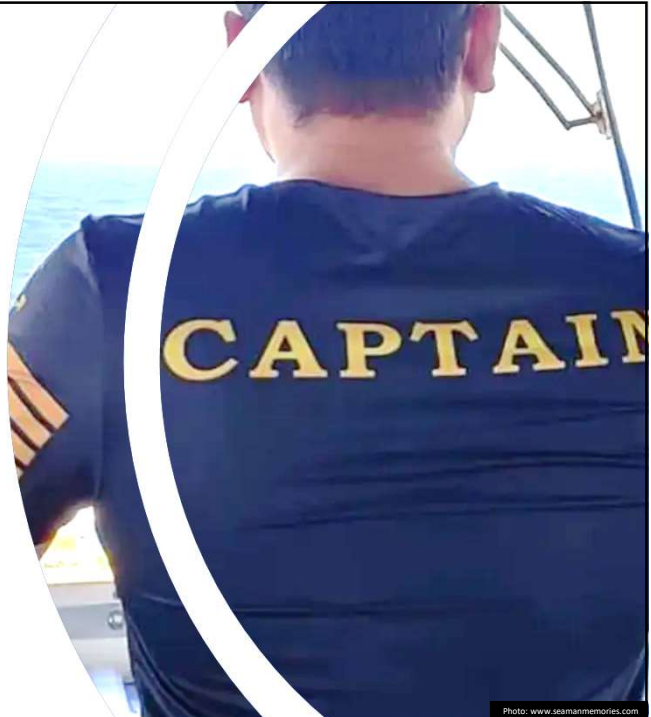


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COMMON TERMINOLOGY

Commonly agreed-upon terms and definitions form the basis of **clear communication**, **productive dialogue**, and efficient creation of regulatory frameworks and **standardisation.**



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COMMON TERMINOLOGY

is fundamental to:

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



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COMMON TERMINOLOGY

It will ensure the **efficient creation** of new regulations and support the development of automation **across different transport modes**.

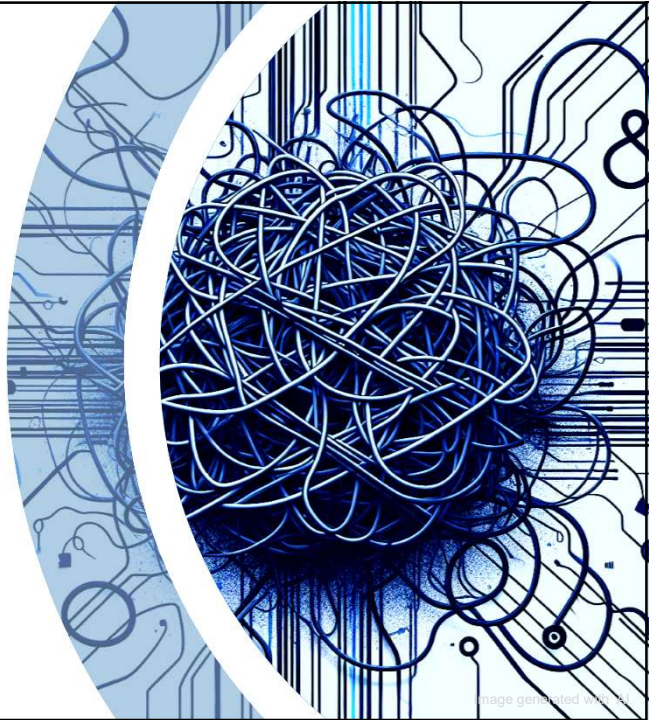


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SHARED UNDERSTANDING OF CORE CONCEPTS

It is imperative to **clarify the difference between core concepts** and eliminate the happy mixed use of terms.



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SHARED UNDERSTANDING OF CORE CONCEPTS

We need to agree on the fundamental **concepts of automation and autonomy** and avoid using terms in a wild and free manner.

Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
Basic Operations	Assisted Operations	Partial Automation	Conditional Automation	High Automation	Autonomous
Human controls vessel	Hands-on Eyes-on Mind-on	Hands-off (at times) Eyes-on Mind-on	Hands-off Eyes-off (at times) Mind-on	Hands-off Eyes-off Mind-off (at times)	Hands-off Eyes-off Mind-off Human-off

Automation Level	Definition	Icon
Level 0	Human controls vessel	
Level 1	Assisted Operations	
Level 2	Partial Automation	
Level 3	Conditional Automation	
Level 4	High Automation	
Level 5	Autonomous	

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ONE SEA Levels of Automation

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0	Basic automation	Human controls the vessel manually or with the help of simple unit-automation (e.g. autopilot).	Human controls the vessel.
1	Assisted operations	The system assists in operations by automation of observations or controls but does not make the connection of these two by the system. (e.g. DP systems)	Hands-on, eyes-on, mind-on
2	Partial automation	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.	Hands-off (sometimes), eyes-on, mind-on
3	Conditional automation	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.	Hands-off, eyes-off (sometimes), mind-on
4	High automation	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.	Hands-off, eyes-off, mind-off (sometimes)
5	Autonomous	Fully autonomous operation of at least one full function/operational mode. Human operator is not needed in those functions/operational models which are automated.	Hands-off, eyes-off, mind-off = human-off



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Non-Mandatory MASS Code

Part 1 Chapter 4 – Definitions

4.22 Modes of operation

means the condition(s) under which the functions of a MASS are operated, i.e.

autonomous

or

remotely-operated,

with or without persons on board.



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For the Regulatory Scoping Exercise DEGREES OF AUTONOMY

Degree one:

- Ship with automated processes and decision support

Degree two:

- Remotely controlled ship with seafarers on board

Degree three:

- Remotely controlled ship without seafarers on board

Degree four:

- Fully autonomous ship



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MODES OF OPERATION

Guidance on Chapter 8 (Operational context)

4.1 Modes of operation

- allocation
 - (human or software),
- supervision
 - (human and/or software),
- location of supervision
 - (on board or remote)



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OPERATING MODES

- Autonomous ship
 - No human attendance
- Partly Autonomous Ship
 - One or more systems
- Periodically Autonomous Ship
 - Autonomous operation under certain conditions, otherwise human attended.



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“One Sea's vision is a safer and more sustainable maritime transport system which builds on the efficient use of advanced automation and combines human ingenuity with cutting-edge technology.”

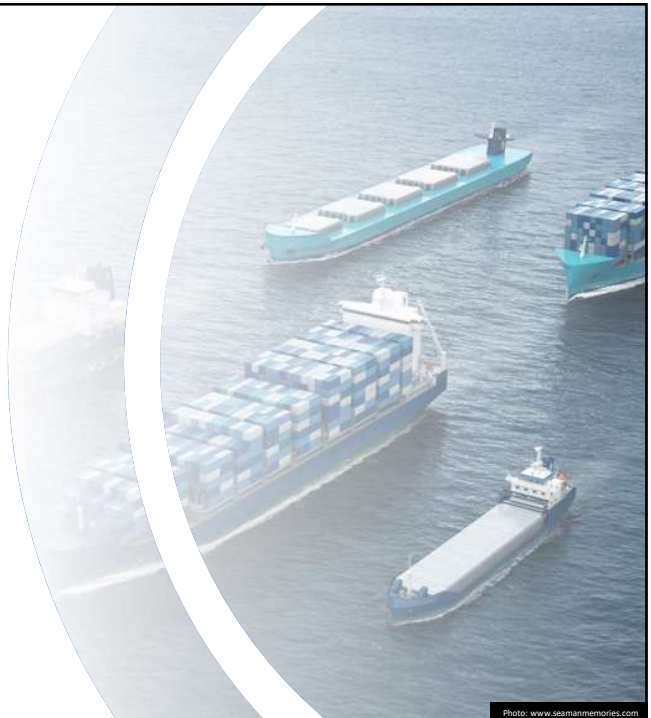


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