MASS

(Maritime Autonomous Surface Ships)

: Proposals of Amendment to STCW Convention regarding MASS

The 2018 Mock IMO Assembly

Team MASSY

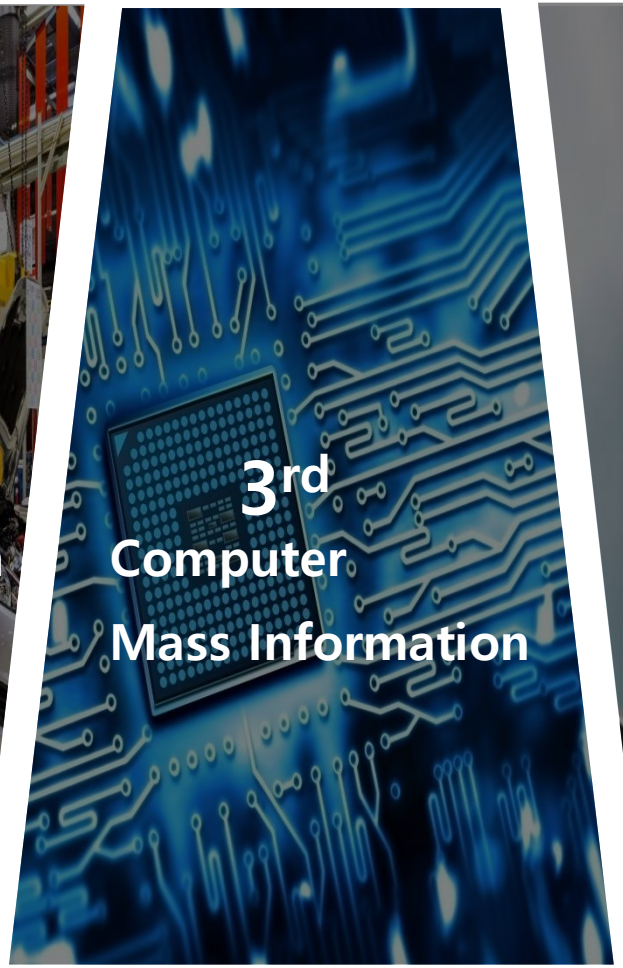
INDEX

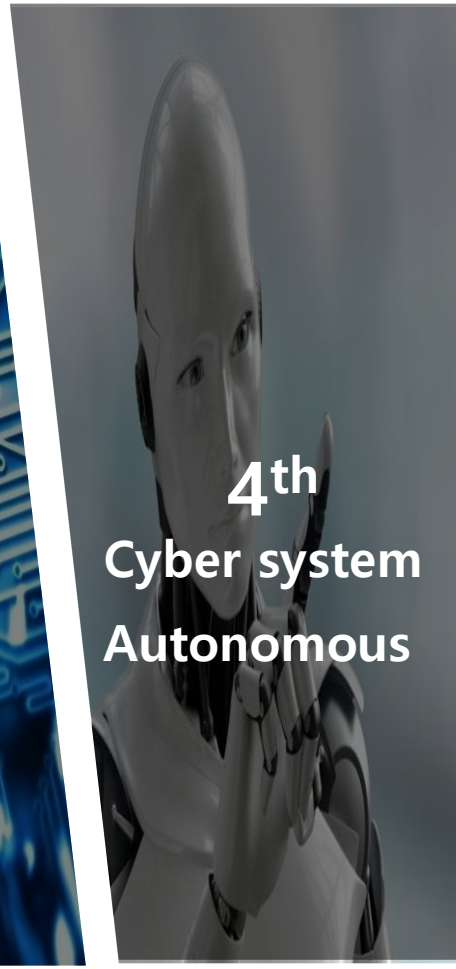
01 Background

4th Industrial Revolution

[4th Industrial Revolution]

The Fourth Major Industry Era since the initial Industrial Revolution of the 18th century





Definition & Theory

[Definition of MASS]

WATERBORNE TP

"Hybrid-type smart ships that operates completely independently without the supervision and instruction from the shore vessel operator"

The Royal Institution of Naval Architects

"Ships that use automated systems for handling navigation and engine control"

ABS® FOUNDED 1862

"Ships equipped with a wide range of sensor equipment and automated navigation, propulsion and other auxiliary devices to detect and execute commands on their own"

IMO

"A ship which, to a varying degree, can operate independently without human interaction"

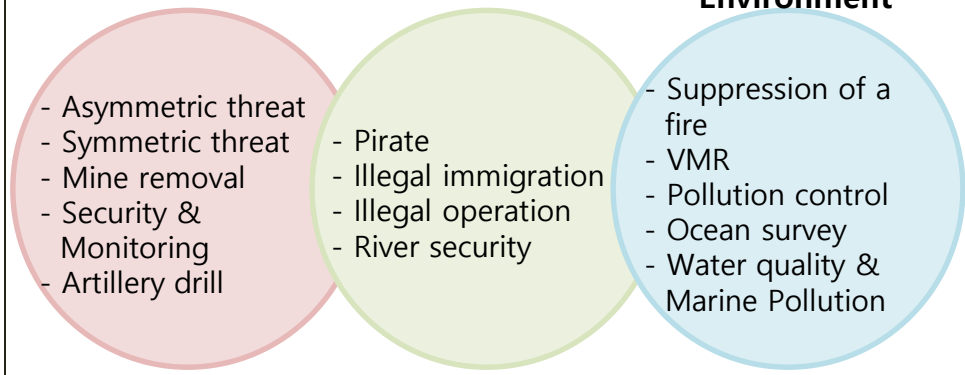
Background The Advent of Automated Vessels

~1990

- First developed for military purposes, in the World War II.
- Used for Removal of mines and tests for radioactive contamination by the U.S. Navy
- Canada unmanned ship : COMOX, etc.

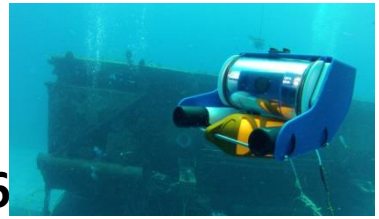
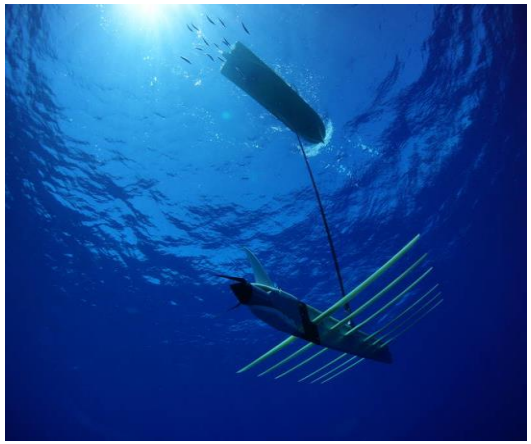

1990 ~

- Expanding utilization for specific purposes, such as scientific investigation and port monitoring



2000

- Integration with sensors, driving methods, information and communication technologies, etc.
- A variety of high-tech applications spread

2010 ~

- Efforts to develop large unmanned vessels such as trade/cargo ships began
- Efforts and confidence to justify the economy / safety, etc..




Status of MASS Development

[Roadmap to Marine 4.0: Ship Intelligence]

2035

➢ **Autonomous unmanned ocean-going ship[2035]**

2030

➢ **Remote controlled unmanned ocean-going ship [2030]**

The system is able to make decisions and determine action by itself

2025

➢ **Remote controlled unmanned costal vessel [2025]**

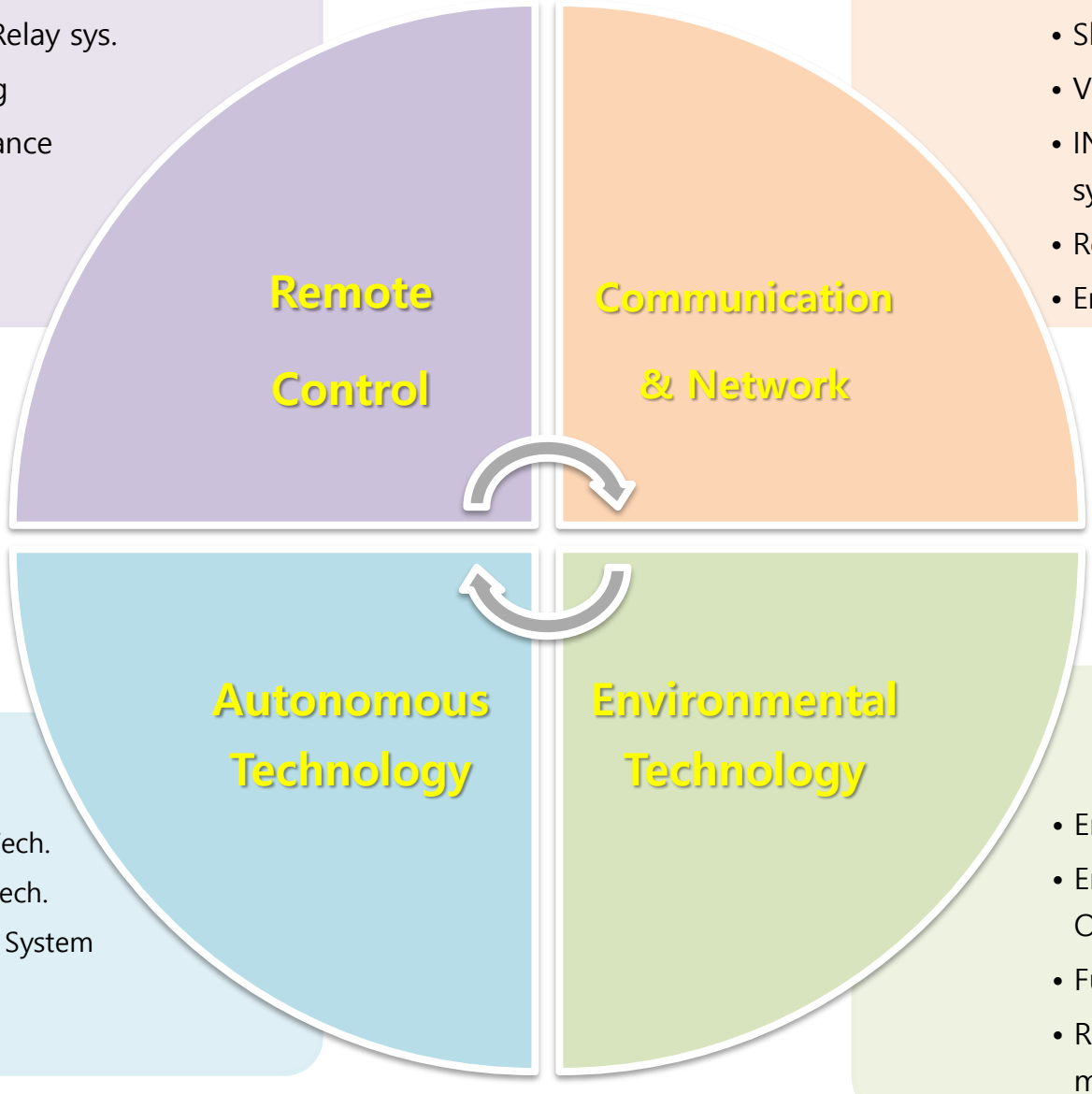
2020

➢ **Reduced crew with remote support and operation of certain functions**

From Rolls Royce marine 4.0

The Technology of MASS

- Image Processing
- Communication Relay sys.
- Status Monitoring
- Remote Maintenance
- Big Data
- Twin Tech.



- Sensor Module
- Ship Cyber Security
- VHF Exchange Data sys.
- INMARSAT Exchange Data sys.
- Route Interchange
- Enhanced PNT Tech

- Autonomous Nav. Tech.
- Autonomous Eng. Tech.
- Collision Avoidance System
- Port sync. Nav.

- Environmental Monitoring
- Energy Efficiency Optimization
- Fuel Economy Analytics
- Remote SOX, NOX management

02 Why Necessary

The Transition of Seaman

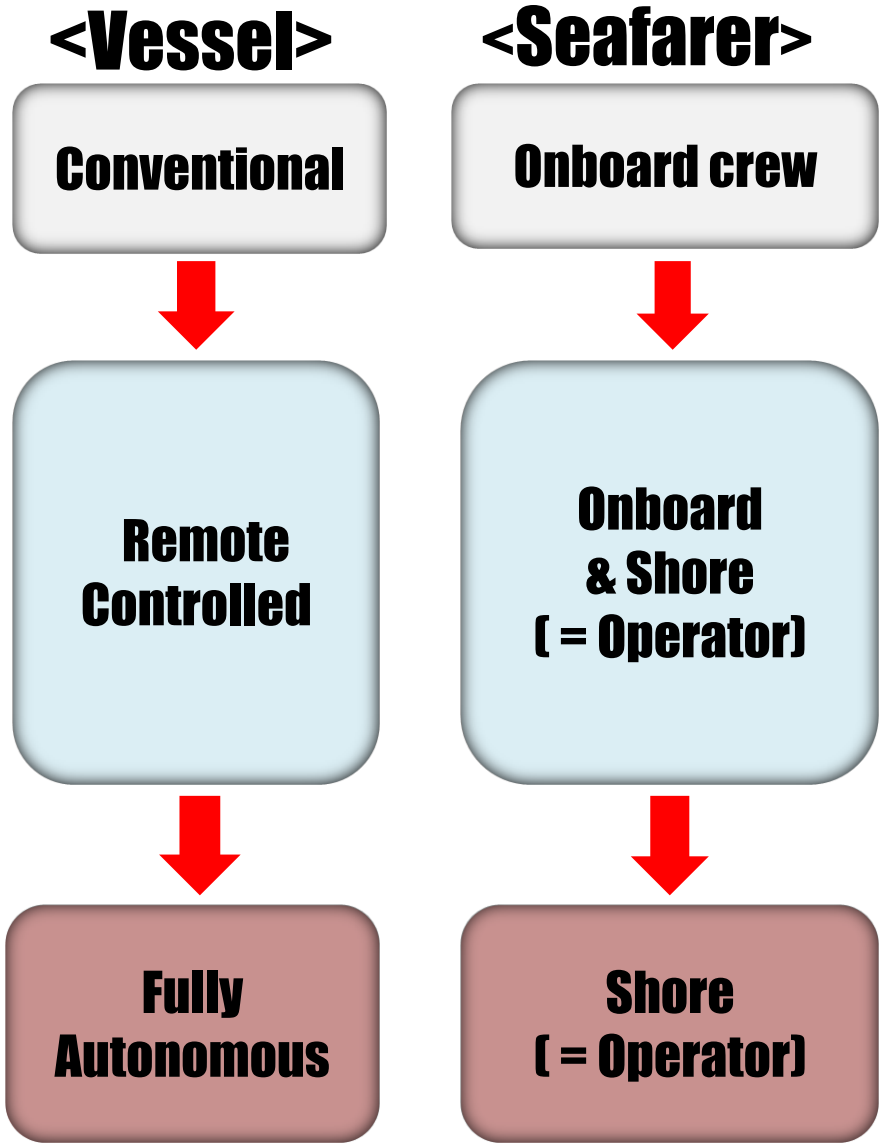
[From Sea to Shore]

Lloyd's Register Autonomy Level

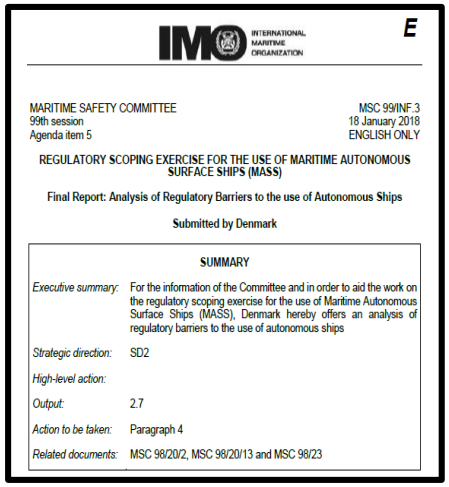
- AL0: (Manual steering) The Operator is on board or performs remote control via radio link.
- AL1: (Decision-support on board) The Operator monitors and changes the course and speed, if necessary.

- AL2: (On-board or Shore-Based decision support) Monitoring operation and surroundings. Proposals for interventions can be given by algorithms.
- AL3: (Execution with human being who monitors and approves) Monitoring the system's function and approving actions before they are executed.
- AL4: (Execution with human being who monitors and can intervene) Monitoring can be shored-based. Only if considered necessary.

- AL5: (Monitored Autonomy) Overall goals have been determined by an operator. Monitoring may be Shore-Based.
- AL6: (Full Autonomy) the system makes its own decisions. Overall goals may have been established by the system. Shore-Based monitoring.



Recent Discussions in IMO



IMO INTERNATIONAL MARITIME ORGANIZATION E

MARITIME SAFETY COMMITTEE
99th session
Agenda item 5

MSC 99/INF.3
18 January 2018
ENGLISH ONLY

REGULATORY SCOPING EXERCISE FOR THE USE OF MARITIME AUTONOMOUS SURFACE SHIPS (MASS)

Final Report: Analysis of Regulatory Barriers to the use of Autonomous Ships

Submitted by Denmark

SUMMARY

Executive summary: For the information of the Committee and in order to aid the work on the regulatory scoping exercise for the use of Maritime Autonomous Surface Ships (MASS), Denmark hereby offers an analysis of regulatory barriers to the use of autonomous ships

Strategic direction: SD2

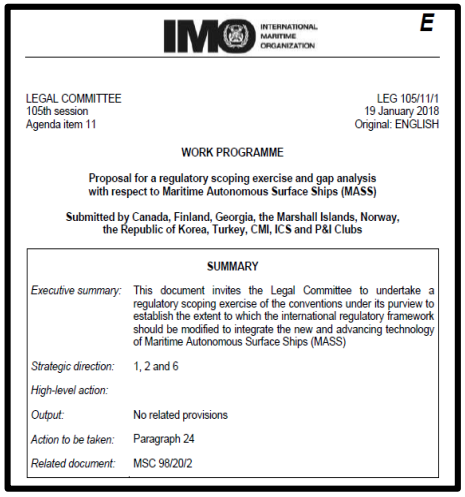
High-level action:

Output: 2.7

Action to be taken: Paragraph 4

Related documents: MSC 98/20/2, MSC 98/20/13 and MSC 98/23

IMO MSC 99/INF.3



IMO INTERNATIONAL MARITIME ORGANIZATION E

LEGAL COMMITTEE
105th session
Agenda item 11

LEG 105/11/1
19 January 2018
Original: ENGLISH

WORK PROGRAMME

Proposal for a regulatory scoping exercise and gap analysis with respect to Maritime Autonomous Surface Ships (MASS)

Submitted by Canada, Finland, Georgia, the Marshall Islands, Norway, the Republic of Korea, Turkey, CMI, ICS and P&I Clubs

SUMMARY

Executive summary: This document invites the Legal Committee to undertake a regulatory scoping exercise of the conventions under its purview to establish the extent to which the international regulatory framework should be modified to integrate the new and advancing technology of Maritime Autonomous Surface Ships (MASS)

Strategic direction: 1, 2 and 6

High-level action:

Output: No related provisions

Action to be taken: Paragraph 24

Related document: MSC 98/20/2

IMO LEG 105/11/1

- Recent **IMO documents** shows **strong emphasis** on Autonomous ships.
- Majority are in compliance to the rise of **MASS technology**.

IMO

On the 2018-2023 List of Outputs, announced by the IMO, MASS is included in the SD2(Output number; 2.7) category

As the IMO percepts the significance of MASS,

- **The definition and new terms for Operator is needed!**
- **Proposals of Competences for Operators needs to be discussed!**

Definition of Seafarers

1. STCW Purpose :

"to promote safety of life and property at sea and the protection of the marine environment"

2. Article IX of the Convention for flag States :

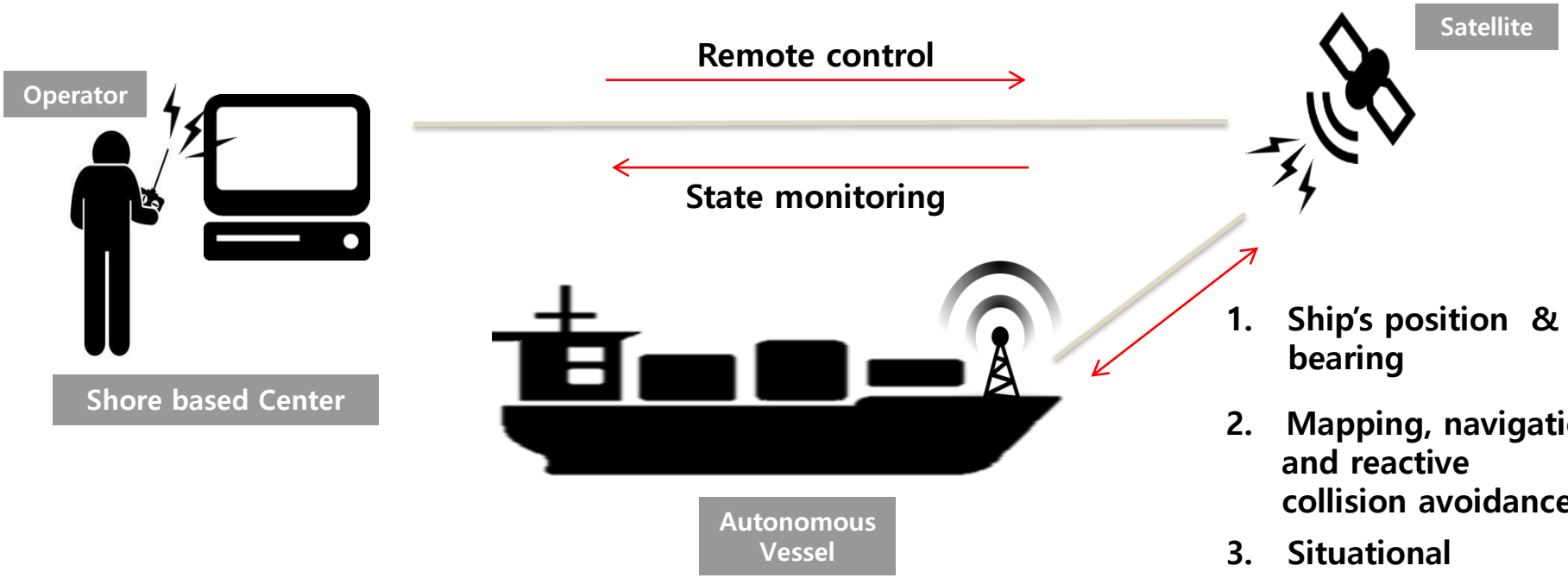
"Educational and training arrangements, including those involving sea-going service and shipboard organization especially adapted to technical developments and to special types of ships and trades

- MSC 99/INF.3 -

OPERATOR ≠ **SEAFARER**

Shore Based Ship Operator

[Duty of SBSO]



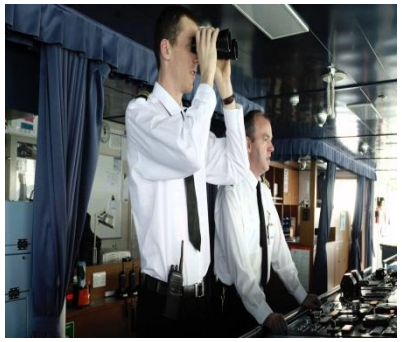
OPERATOR

Ambiguous & too broad

Shore Based Ship Operator

(SBSO)

Feature of S.B.S.O



Deck Officer

Engineer Officer

Remote Control

Communication & Network

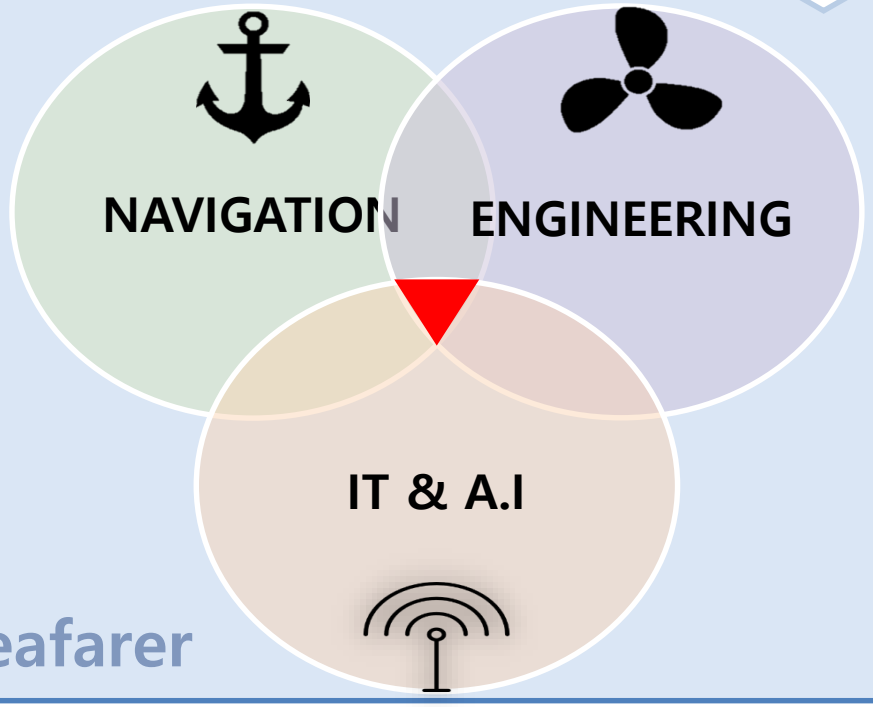
Autonomous Tech.

Monitoring

Environmental Tech.

Conventional Operator

MASS technology

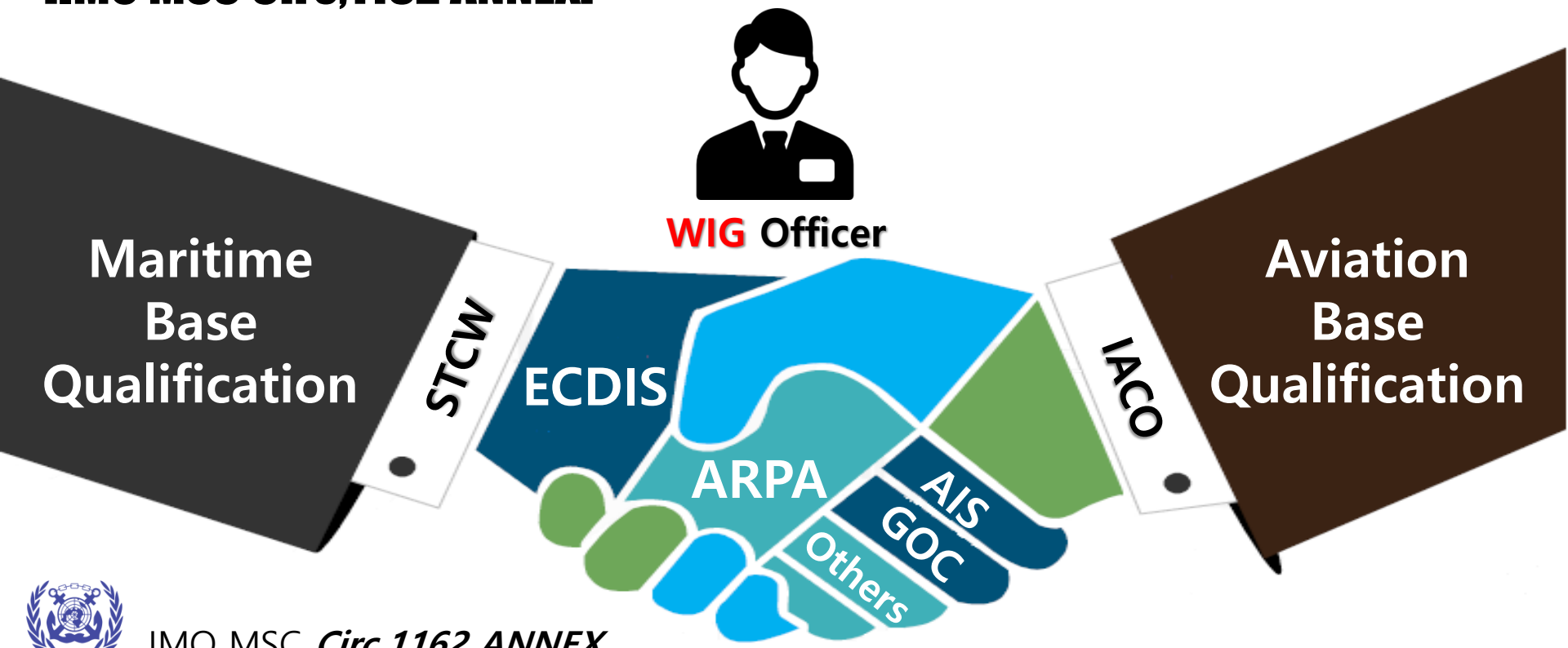


Shore Based Ship Operator (SBSO)

1. SBSO is included in the boundary of seafarer
2. 66% of required skills is maritime skills
3. Works in a Shore Based Center
4. Dual Officer

Minimum Requirements of WIG Officers

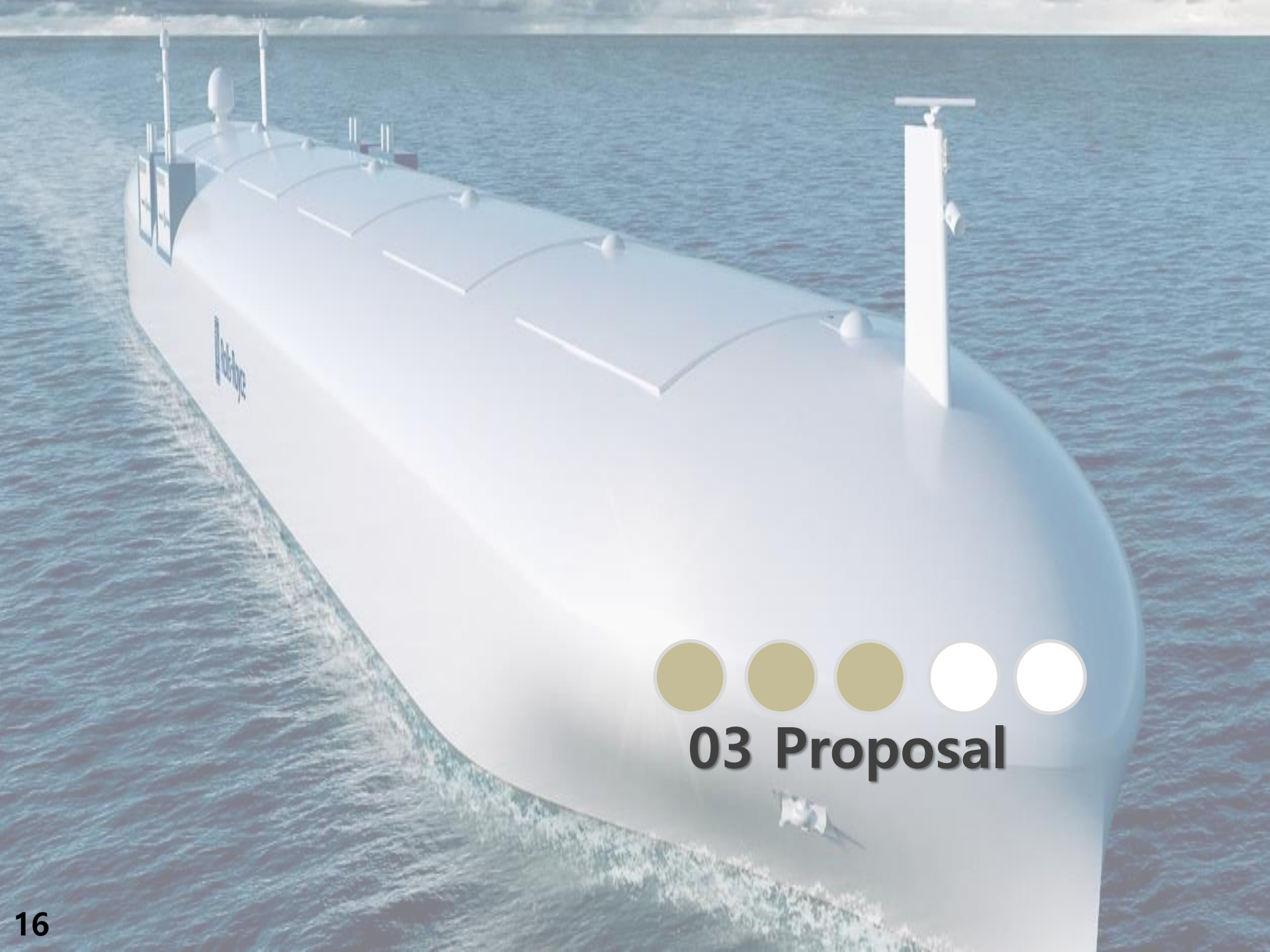
[IMO MSC Circ,1162 ANNEX]



IMO MSC ***Circ,1162 ANNEX***

3. General requirements regarding base qualification

.1 A maritime base qualification referred to in paragraph 2.1 should meet the requirements listed in the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW), as amended. Similarly, an aviation base qualification should meet the requirements of the International Civil Aviation Organization (IACO), listed in the Chicago Convention on International Civil Aviation, 1944, as amended.



03 Proposal

Proposals to the IMO

[3 Main Proposals to the IMO]

1. Amending the title of Chapter VII

2. The definition of the SBSO

3. Proposing the competences of the SBSO

Amendment to the STCW Convention will be done

Proposals to the IMO

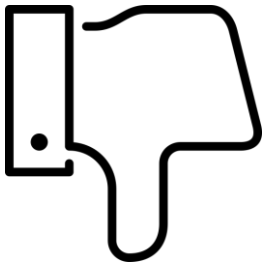
1 Amending the tile of Chapter VII

Chapter VII Alternative certification

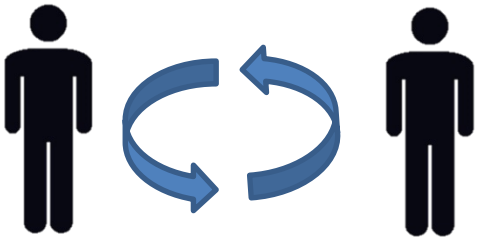
⇩

Chapter VII Shore Based Ship Operator

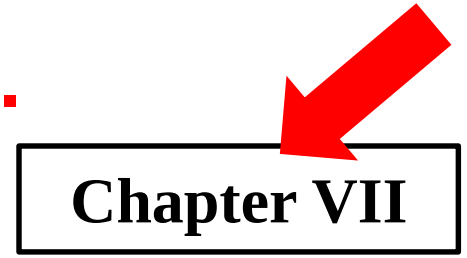
Why?

1. 

The current Operator policy is ineffective

2. 

Similarities competences

3. 

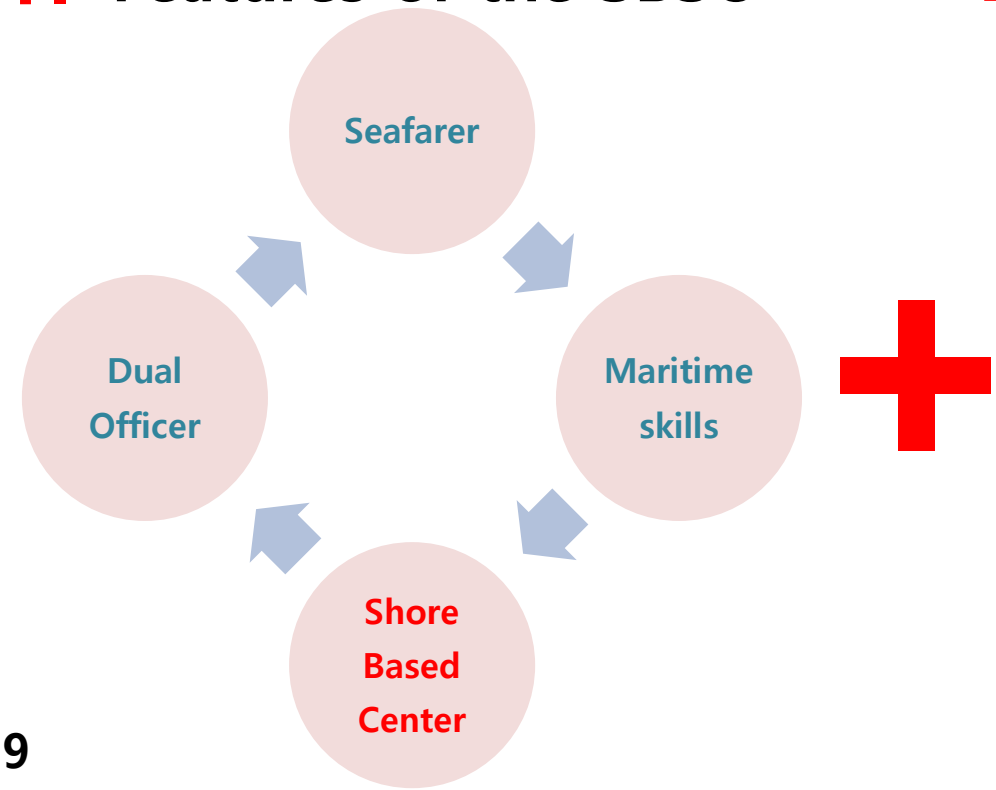
Proposal of Chapter VII

Proposals to the IMO

2 The definition of SBSO

Shore-Based Ship Operator means a person who takes care of or monitors the navigation of one or more autonomous ship in a shore-based center and hold a qualification in accordance with the provision of Chapter XII of the Convention.

1. Features of the SBSO



2. Definitions from the IMO

IMO

MSC 99/INF.3

*"**OPERATOR**: A person holding the required qualifications who takes care of or monitors the navigation of one or more autonomous ships without being physically on board the ship"*

Proposals to the IMO

3 Competences of the SBSO (NAV.)

Deck Officer Section A-II/1 (Column 1)

Deck Officer Section A-VII/4 (Column 1)

SBSO Competence as Navigator

Functions	Navigation at the operational level	Cargo handling and stowage at the operational level	Controlling the operational and care for persons on board at the operational level
	- Plan and conduct a passage and determine position - Maintain a safe navigational watch - Use of radar and ARPA to maintain safety of navigation - Use of ECDIS to maintain the safety navigation - Use the IMO Standard Marine Communication Phrases and use English in written and oral form - Transmit and receive information by visual signaling - Maneuver the ship	- Monitor the loading, stowage, securing, care during the voyage and unloading of cargoes	- Ensure compliance with pollution prevention requirements - Maintain seaworthiness of the ship - Monitor compliance with legislative requirements
	written and oral form - Transmit and receive information by visual signaling		~~to the safety of personnel and ship~~

Chapter VII Shore Based Ship Operator

Proposals to the IMO

3 Competences of the SBSO (NAV.)

Deck Officer Section A-II/2 (Column 1)

Deck Officer Section A-VII/5 (Column 1)

SBSO Competence as Navigator

Functions	Navigation at the management level	Cargo handling and stowage at the management level	Controlling the operational and care at the management level
	- Plan a voyage - Determine position and the accuracy of resultant position fix by any means - Establish watch-keeping arrangements and procedures - Maintain safe navigation through the use of radar and ARPA and modern nav. sys - Forecast weather and oceanographic condition - Manoeuver and handle a ship in all conditions - Operate remote controls of propulsion plant and engineering systems and services	- Plan and ensure safe loading stowage, securing and unloading of cargoes - Assess reported defects and damages to cargo spaces, hatch covers and ballast tanks and take appropriate actions - Carriage of dangerous goods	- Control trim, stability and stress - Monitor and control compliance with legislative requirements and measures to ensure the protection of the marine environment

conditions
- Operate remote controls of propulsion plant and engineering

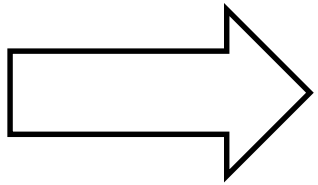
~~- Organize and manage the crew~~
~~- Organize and manage the provision of medical care onboard~~

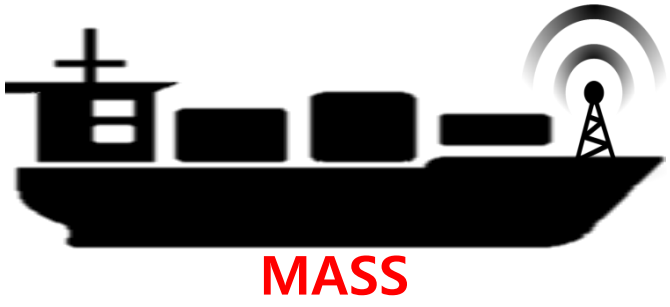
Chapter VII Shore Based Ship Operator

Proposals to the IMO

3 Competences of the SBSO (NAV.)

Deck Officer Section A-II/3

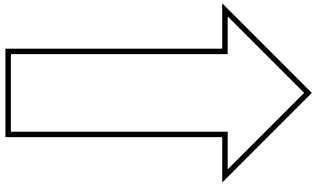


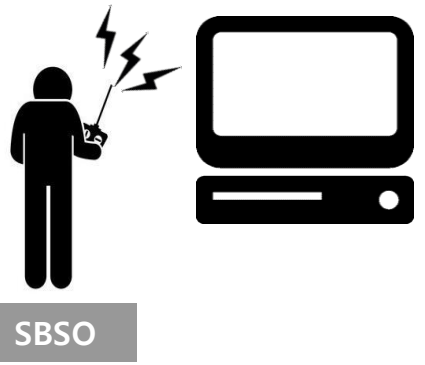


Ships of 500 GT or less

No need of tonnage standard

Deck Officer Section A-II/4





Need support level seafarer

No need of support level seafarer

Proposals to the IMO

3 Competences of the SBSO (ENG.)

Engineer Officer Section A-III/1 (Column 1)

Engineer Officer section A-VII/6 (Column 1)

Present Engineer Officer Section Competence

SBSO Competence as Engineer

Function	Marine engineering at the operational level	Electrical, electronic and control engineering
	- Maintain a safe engineering watch - Use English in written and oral form - Operate main and auxiliary machinery and associated control systems - Operate fuel, lubrication, ballast and other pumping systems and associated control systems	- Operate electrical, electronic and control systems

systems

~~and team working skills~~
~~- Contribute to the safety of personnel and ship~~

Chapter VII Shore Based Ship Operator

Proposals to the IMO

3 Competences of the SBSO (ENG.)

Engineer Officer Section A-III/2 (Column 1)

Engineer Officer Section A-VII/7 (Column 1)

Present Engineer Officer Section Competence

SBSO Competence as Engineer

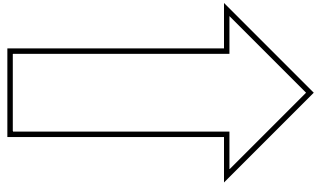
Function	Marine engineering at the management level	Electrical, electronic and control engineering at the management level	Maintenance and repair at the management level	Controlling the operation of the ship care at the management level
	- Plan and schedule operations - Start up and shut down main propulsion and auxiliary machinery, including associated systems - Monitor and evaluate engine performance and capacity - Maintain safety of engine equipment, systems and services - Manage fuel and ballast operations	- Operate electrical and electronic control equipment - Tests, defect faults and maintain and restore electronic and electrical and electronic control equipment to operating condition	- Detect and identify the cause of machinery malfunctions and correct faults	- Control trim, stability and stress - Monitor and control compliance with legislative requirements and measures to ensure protection of the marine environment
	~~- Use internal communication systems~~			~~handle emergency situations~~ ~~- Organize and manage the~~

Chapter VII Shore Based Ship Operator

Proposals to the IMO

3 Competences of the SBSO (ENG.)

Engine Officer Section A-II/3

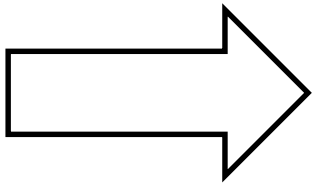


MASS

Ships powered by main propulsion machinery of between 750kW and 3000kW propulsion power

No need of propulsion power standard

Engine Officer Section A-III/4



Need support level seafarer

No need of support level seafarer

Proposals to the IMO

3 Competences of the SBSO (TECH.)

Operator Section A-VII/8

MASS Technology Competence

1 Remote Control

- Image processing
- Communication Relay System
- Status monitoring
- Remote maintenance
- Big Data
- Twin Tech.

2 Communication & Network

- Sensor Module
- Ship Cyber Security
- VHF Exchange Data Sys.
- INMARSAT Exchange Data Sys.
- Route Interchange
- Enhanced PNT Technology

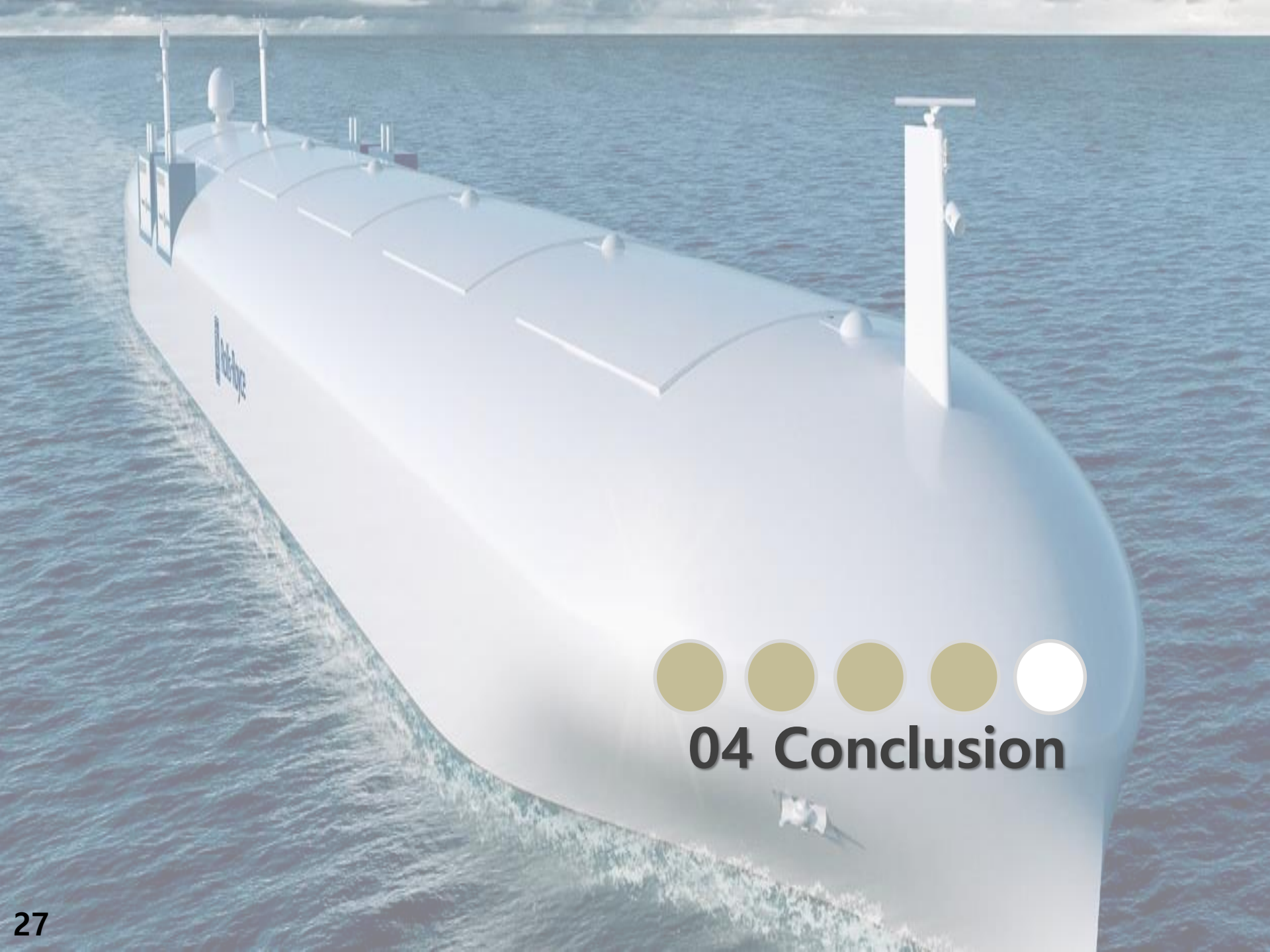
3 Autonomous Technology

- Autonomous Nav. Technology
- Electronic Nav. Technology
- Collision Avoidance System
- Obstacle Detection

4 Environmental Technology

- Environmental Monitoring
- Energy Efficiency Optimization
- Fuel economy Analytics
- Remote SOX, NOX management

Chapter VII Shore Based Ship Operator



04 Conclusion

Proposals of amendment to STCW convention

1 Amendment to the STCW

Chapter I	General provisions
Chapter II	Master and deck department
Chapter III	Engine department
Chapter IV	Radiocommunication and radio personnel
Chapter V	Special training requirements for personnel on certain types of ships
Chapter VI	Emergency, occupational safety, medical care and survival functions
Chapter VII	Shore Based Ship Operator
Chapter VIII	Watchkeeping

Proposals of amendment to STCW convention

2 Amendment to the STCW

Chapter I General provisions

Regulation 1/1

Definitions and clarifications

1 For the purpose of the Convention, unless expressly provided otherwise:

(...)

. 25 Seagoing service means service on board a ship relevant to the issue of a certificate or other qualification;

. 26 INSERT the following sentence

Shore-Based Ship Operator means a person who takes care of or monitors the navigation of one or more autonomous ship in a shore-based center and hold a qualification in accordance with the provision of Chapter XII of the Convention.

3 Amendment to the STCW

Chapter VII Shore Based Ship Operator

Regulation VII/1

Mandatory minimum requirements for the certification of the Ship Shore Based Operator

1 Every candidate for certification shall

.1 be required to demonstrate the competence to undertake at the navigational level, the task, duties and responsibilities listed in column 1 of table A-VII/4 and A-VII/5

.2 be required to demonstrate the competence to undertake at the engineering level, the task, duties and responsibilities listed in column 1 of table A-VII/6 and A-VII/7

.3 be required to demonstrate the competence to undertake at the technological level, the task, duties and responsibilities listed in column 1 of table A-VII/8

3 Amendment to the STCW

Table A-VII/4

Specifications of minimum standard of competence for Shore Based Ship Operator as NAVIGATOR

SBSO Competence as Navigator			
Functions	Navigation at the operational level	Cargo handling and stowage at the operational level	Controlling the operational and care for persons on board at the operational level
	- Plan and conduct a passage and determine position - Maintain a safe navigational watch - Use of radar and ARPA to maintain safety of navigation - Use of ECDIS to maintain the safety navigation - Use the IMO Standard Marine Communication Phrases and use English in written and oral form - Transmit and receive information by visual signaling - Maneuver the ship	- Monitor the loading, stowage, securing, care during the voyage and unloading of cargoes	- Ensure compliance with pollution prevention requirements - Maintain seaworthiness of the ship - Monitor compliance with legislative requirements

Table A-VII/5

Specifications of minimum standard of competence for Shore Based Ship Operator as NAVIGATOR

SBSO Competence as Navigator			
Functions	Navigation at the management level	Cargo handling and stowage at the management level	Controlling the operational and care at the management level
	- Plan a voyage - Determine position and the accuracy of resultant position fix by any means - Establish watch-keeping arrangements and procedures - Maintain safe navigation through the use of radar and ARPA and modern nav. sys - Forecast weather and oceanographic condition - Manoeuver and handle a ship in all conditions - Operate remote controls of propulsion plant and engineering systems and services	- Plan and ensure safe loading stowage, securing and unloading of cargoes - Assess reported defects and damages to cargo spaces, hatch covers and ballast tanks and take appropriate actions - Carriage of dangerous goods	- Control trim, stability and stress - Monitor and control compliance with legislative requirements and measures to ensure the protection of the marine environment

3 Amendment to the STCW

Table A-VII/6

Specifications of minimum standard of competence for Shore Based Ship Operator as ENGINEER

SBSO Competence as Engineer		
Function	Marine engineering at the operational level	Electrical, electronic and control engineering
	- Maintain a safe engineering watch - Use English in written and oral form - Operate main and auxiliary machinery and associated control systems - Operate fuel, lubrication, ballast and other pumping systems and associated control systems	- Operate electrical, electronic and control systems

Table A-VII/7

Specifications of minimum standard of competence for Shore Based Ship Operator as ENGINEER

SBSO Competence as Engineer				
Function	Marine engineering at the management level	Electrical, electronic and control engineering at the management level	Maintenance and repair at the management level	Controlling the operation of the ship care at the management level
	- Plan and schedule operations - Start up and shut down main propulsion and auxiliary machinery, including associated systems - Monitor and evaluate engine performance and capacity - Maintain safety of engine equipment, systems and services - Manage fuel and ballast operations	- Operate electrical and electronic control equipment - Tests, defect faults and maintain and restore electronic and electrical and electronic control equipment to operating condition	- Detect and identify the cause of machinery malfunctions and correct faults	- Control trim, stability and stress - Monitor and control compliance with legislative requirements and measures to ensure protection of the marine environment

Proposals of amendment to STCW convention

3 Amendment to the STCW

Table A-VII/8

Specifications of minimum standard of competence for Shore Based Ship Operator as TECHNICIAN

SBSO Competence as Technician			
Remote Control	Communication & Network	Autonomous Technology	Environmental Technology
- Use computer algorithms to perform image processing on digital. - Use satellites as components of a communication system to relay signals - Act of diagnosing a given symptom, issue or problem from a distance - Remote maintenance - Collect extremely large data sets to reveal patterns, trends, and associations - Twin Technology; compare more than one virtual and physical worlds, analysis of data and monitoring of systems to head off problems	- Sensor module - Protect ship's cyber security from outside's threat or hacking - Exchange data between ship to ship, ship to shore through VHF - Exchange data between ship to ship, ship to shore through INMARSAT - Set route to interchange data between ship to ship, ship to shore -Ability to enhance and operate Positioning, Navigation, and Timing technology	- The activity of autonomously defining a trajectory through the environment in order to reach a specified location - Electric Navigation technology - System that makes ship prevent or reduce the severity of a collision by herself - Ability to detect upcoming obstacle	- Monitor the quality of the environment - Energy Efficiency Optimization - Fuel Economy Analytics - Manage SOX and NOX form distance

"New technologies will dramatically change the nature of work across all industries and occupations."

— Klaus Schwab,

Reference

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THANK YOU

Do you have any Questions?