European Maritime Safety Agency

CMOROC Appendix D - Processes

Identification of Competences for MASS Operators in Remote Operation Centres

V 2.2

Date: 20.10.2023



About this study:

This report was commissioned by the European Maritime Safety Agency (EMSA) under framework contract 2022/EMSA/OP/24/2021

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Recommended citation:

European Maritime Safety Agency CMOROC Identification of Competences for MASS Operators in Remote Operation Centres EMSA, Lisbon

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Figure 2: Process map for MASS operations

Fundamentals About Processes

Processes

In this project is followed a process-oriented approach. The process descriptions are designed according to the general definition of a process.



Figure 1: Scheme of elements of single processes (ISO 9001:2015)

Process Description Structure

The single processes are described in a systematic structure. They are in accordance with the requirements of ISO 9001:2015 (Clause 4.4.1).

Process nn	<process name=""></process>
Scope of	In which areas is the process used?
application	Differentiations are done for:
	> Ship type
	> "With crew on board" and "without crew on board".
Process	What is to achieve by the process as a general objective?
objectives	
Process	Operators who are involved in this process.
operators	Differentiated by "MASS operators in ROC" and "MASS operators on board".
	Assignment to operational or management level.
	Definition of the location and workstation where the process is mainly
	operated.
	Assumption of RACI for the different roles:
	R=Responsibility, A-Accountability, C-Consulted, I-Informed
Interfaces	Interfaces to other functions.
Event: input	Specific input to process, trigger to start, starting point.
Process	Brief description of tasks, activities, and functionalities.
description	
Resources	Needed resources to ensure availability of the process, such as equipment,
needed	systems, interfaces, HMI.
	Marked whether needed for
	MASS: it is with crew on board
	ROC: it is with or without crew on board
Regulations	Major regulations to be considered in the process.
Event: output	Specific outcomes, results of the process, ending point
Required	Required competences,
competences	differentiated by the different roles:
	C/L = competence level
	STCW = related table
	MASS = additional competences needed by MASS operators (new table)
Additional	Only if required for further explanations.
comments	

Process Map

The purpose of the process map is to allow a general overview about all main processes related to the MASS system.



Figure 2: Process map for MASS operations

Management Processes

M.1 Organisation of MASS-ROC-Systems

Process M.1	Organisation of MASS-R	OC-Systems			
Scope of	All types of MASS				
application	 A) Dry Cargo – Container Feeder – short sea 				
	B) Ferry – RoPax – one hour passage				
	 C) Dry Cargo – Bulk Carrier – long distances MASS with crew on board > Remote Operation Centre 				
	MASS without crew on board				
	> Remote Operation Centre				
Process	To achieve smooth and safe	operation of the en	tire MASS system		
objectives					
Process	MASS operators in ROC	Level	in ROC		RACI
operators	> Senior Navigator	> Management	> Planning station		R, A
	> Senior Engineer	> Management	-		R
Interfaces	> System Administrator				
	> System Specialists (e.g. I	T, automation,)			
	> Shipping Companies Mar	,			
Event: input	Concept of Operations of a M	•	nisational, technologic	al, and	human
	related perspectives)	, , , , , , , , , , , , , , , , , , , ,	, 3	,	
Process	Manage all processes of MA	SS svstem:			
description	> Plan processes	,			
•	> Develop processes				
	> Implement processes	s and improvements	5		
	Determine and maintain the o	•			
		•	ith allocation of tasks	and	
	responsibilities	,			
	> Determine required r	esources of human	s and technologies		
	Develop and manage the Hu		-		
	> Work and rest time n				
	> Ergonomic design of	НМІ			
Resources	Personnel				
needed	> Manpower of operators, a	and specialists			
	Equipment:				
	> Commercial IT-system				
Regulations	MASS regulations				
0	International shipping law				
	National regulatory framewor	k, e.g. labour law			
Event: output	Implemented organisational s	structure and proces	sses for the entire MA	SS sys	tem
Required	The MASS Senior Operator		eer) on	C/L	STCW
competences	management level is able				
MASS Senior	regarding using and applying		ing (C/L 4)		
Operators	to use organisation d	•		3	MASS
Management	to implement commu	inication brokers to	achieve seamless	3	MASS
Level	internet access				
	regarding evaluating (C/L 5)	and creating (C/L 6)		
	to organize MASS sy	vstems,		5	MASS
	to implement process	s management,		5	MASS

Process M.1	Organisation of MASS-ROC-Systems		
	 to develop, implement and supervise standard operational procedures, to develop and determine structural organisation, 	5	MASS
	to allocate tasks and functions to operators,	5	MASS
	to implement and improve human-machine interfaces.	5	MASS
		5	MASS
Additional	Л.		
comments			

M.2 General Management of MASS-ROC-Systems

Process M.2	General Management of MASS-ROC Systems					
Scope of	All types of MASS					
application	A) Dry Cargo – Container Feeder – short sea					
	B) Ferry – RoPax – one h	our passage				
	C) Dry Cargo – Bulk Carri	er – long distances				
	MASS with crew on board					
	> Remote Operation Cer	ntre				
	MASS without crew on board	l				
	> Remote Operation Cer	ntre				
Process	To manage the success factor	To manage the success factor "human resources" of a MASS-System by				
objectives	appropriate leadership and est	ablishing an operation	al culture for the entire	system		
Process	MASS operators in ROC	Level	in ROC	RACI		
operators	> Senior Navigators	> Management	> Planning station	R, A		
	> Navigators	> Operational		С		
	> Senior Engineers	> Management	> Planning station	R		
	> Engineers	> Operational		С		
	> System Administrator	> Operational		С		
Interfaces	> MASS System Specialists (e.g. IT, automation,	.)			
	> Shipping Company- Operat	ions				
	> Shipping Companies - Man	agement				
Event: input	Organisation of MASS-System	with all operators and	technologies			
Process	Leadership					
description	> Apply situational leadership					
	> Support and improve team	vork				
	> Allocate tasks and manage	workloads				
	> Improve decision making					
	> Establish a just culture					
	Situational awareness					
	> Control workload to avoid fatigue					
	> Improve the human-machine-interaction, especially for using sensors and trust in automation					
	 Keep situational awareness in all situations, especially when using human- 					
	machine-interfaces					
	MASS certification					
	> Control of all required certif	icates to operate the N	//ASS			
Resources	Personnel					
needed	> Manpower of management	, operators, and specia	alists			

Process M.2	General Management of MASS-ROC Systems		
	 Equipment: Navigational systems (ECDIS, radar, AIS, sounder,) Alarm and control systems (machinery, auxiliary and deck equipment, safety equipment) Information systems (publications, MIS, forecasts, traffic information) Computer systems Sensor data (MASS status) 		
Regulations	MASS regulations		
	International shipping law National regulatory framework, e.g. labour law		
Event: output	Smooth and integrated operations		
Required	The MASS Navigator (operational level) is able	C/L	STCW
competences	regarding knowledge (C/L 1) and understanding (C/L 2)		
MASS	to describe the system of sensors and how to use them to keep	2	MASS
Navigator	situational awareness		
Operational	regarding using and applying (C/L 3) and analysing (C/L 4)		
Level	to use knowledge about shipboard personnel management and training	3	A-II/1
	to apply leadership and teamworking skills	3	A-II/1
	to apply task and workload management	3	A-II/1
	to apply effective resource management	3	A-II/1
	to apply decision-making techniques	3	A-II/1
	to operate the remote-control system with its specific interfaces	3	MASS
	to maintain a safe remote watch	3	MASS
	to maintain appropriate situational awareness when using the human-machine interfaces when monitoring or controlling	3	MASS
	remotely		
Required	The MASS Senior Navigator (management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS Senior	to use leadership and managerial skills	3	A-II/2
Navigator	to apply shipboard personnel management training	3	A-II/2
Management	to apply task and workload management to apply effective	3	A-II/2
Level	resource management	_	
	to apply decision-making techniques	3 3	A-II/2 MASS
	 to apply a MASS-ROC-related resource management to apply international and national regulatory framework for	3	MASS
	MASS and shipping	5	MASS
	to apply national and international regulatory framework for the	3	MASS
	shore-based operators		
	to monitor and control compliance with legislative requirements	3	MASS
	and measures concerning MASS systems		
	regarding evaluating (C/L 5) and creating (C/L 6)		
	to establish a safety culture in the entire MASS-ROC- system	4	MASS
	to improve the human-machine interaction, especially to keep the situational awareness on a high level	5	MASS
	to foster the teamwork and communication in the entire MASS team in ROC and at sea	5	MASS
	to enable teams to work coordinated in different distributed locations	5	MASS

/

Process M.2	General Management of MASS-ROC Systems		
	to identify behaviours of operators in distributed work	5	MASS
	locations		
	to identify the level of situational awareness in a team of	5	MASS
	operators and to improve in case of loss of sufficient S/A		
	to implement and improve systematic decision-making	5	MASS
	procedures in remote monitoring and control		
	to identify too high workloads in the operator and MASS	5	MASS
	team and to reduce stress levels by appropriate measures		
	to apply classification cycles for MASS systems and	5	MASS
	consider intervention scheme requirements	Ū	111/100
	to manage MASS system related certificates	5	MASS
		C/L	STCW
Required	The MASS Engineer (operational level) is able	C/L	SICW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS	to use knowledge about shipboard personnel management and	3	A-III/1
Engineer	training		
Operational	to apply leadership and teamworking skills	3	A-III/1
Level	to apply task and workload management	3	A-III/1
	to apply effective resource management	3	A-III/1
	to apply decision-making techniques	3	A-III/1
	to maintain a safe remote watch	3	MASS
	to maintain appropriate situational awareness by using the	3	MASS
	human-machine interfaces and monitoring or controlling		
	remotely		
	to operate the remote-control systems with its specific	3	MASS
	interfaces		
Required	The MASS Senior Engineer (management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS Senior	to use leadership and managerial skills	3	A-III/2
Engineer	to apply shipboard personnel management training	3	A-III/2
Management	to apply task and workload management	3	A-III/2
Level	to apply effective resource management	3	A-III/2
	to apply decision-making techniques	3	A-III/2
	to apply a MASS-ROC-related resource management	3	MASS
	to apply international and national regulatory framework for	3	MASS
	MASS and shipping	-	
	to apply national and international regulatory framework for the	3	MASS
		-	
	shore-based operators	4	MASS
	shore-based operators to monitor and control compliance with legislative requirements	4	MASS
	shore-based operators to monitor and control compliance with legislative requirements and measures concerning MASS systems	4	MASS
	shore-based operators to monitor and control compliance with legislative requirements and measures concerning MASS systems regarding evaluating (C/L 5) and creating (C/L 6)		
	 shore-based operators to monitor and control compliance with legislative requirements and measures concerning MASS systems <i>regarding evaluating (C/L 5) and creating (C/L 6)</i> to improve the human-machine interaction, especially to keep 	4 5	MASS
	 shore-based operators to monitor and control compliance with legislative requirements and measures concerning MASS systems <i>regarding evaluating (C/L 5) and creating (C/L 6)</i> to improve the human-machine interaction, especially to keep the situational awareness on a high level 	5	MASS
	 shore-based operators to monitor and control compliance with legislative requirements and measures concerning MASS systems <i>regarding evaluating (C/L 5) and creating (C/L 6)</i> to improve the human-machine interaction, especially to keep the situational awareness on a high level to apply classification cycles for MASS systems and consider 		
	 shore-based operators to monitor and control compliance with legislative requirements and measures concerning MASS systems <i>regarding evaluating (C/L 5) and creating (C/L 6)</i> to improve the human-machine interaction, especially to keep the situational awareness on a high level to apply classification cycles for MASS systems and consider intervention schemes requirements 	5 5	MASS MASS
	 shore-based operators to monitor and control compliance with legislative requirements and measures concerning MASS systems <i>regarding evaluating (C/L 5) and creating (C/L 6)</i> to improve the human-machine interaction, especially to keep the situational awareness on a high level to apply classification cycles for MASS systems and consider intervention schemes requirements to manage MASS system related certificates 	5 5 5	MASS MASS MASS
•	 shore-based operators to monitor and control compliance with legislative requirements and measures concerning MASS systems regarding evaluating (C/L 5) and creating (C/L 6) to improve the human-machine interaction, especially to keep the situational awareness on a high level to apply classification cycles for MASS systems and consider intervention schemes requirements to manage MASS system related certificates The MASS System Administrator (operational level) is able 	5 5	MASS MASS
Required	 shore-based operators to monitor and control compliance with legislative requirements and measures concerning MASS systems <i>regarding evaluating (C/L 5) and creating (C/L 6)</i> to improve the human-machine interaction, especially to keep the situational awareness on a high level to apply classification cycles for MASS systems and consider intervention schemes requirements to manage MASS system related certificates The MASS System Administrator (operational level) is able regarding using and applying (C/L 3) and analysing (C/L 4) 	5 5 5 C/L	MASS MASS MASS STCW
competences MASS	 shore-based operators to monitor and control compliance with legislative requirements and measures concerning MASS systems regarding evaluating (C/L 5) and creating (C/L 6) to improve the human-machine interaction, especially to keep the situational awareness on a high level to apply classification cycles for MASS systems and consider intervention schemes requirements to manage MASS system related certificates The MASS System Administrator (operational level) is able regarding using and applying (C/L 3) and analysing (C/L 4) to use knowledge about shipboard personnel management and 	5 5 5	MASS MASS MASS
competences MASS System	 shore-based operators to monitor and control compliance with legislative requirements and measures concerning MASS systems <i>regarding evaluating (C/L 5) and creating (C/L 6)</i> to improve the human-machine interaction, especially to keep the situational awareness on a high level to apply classification cycles for MASS systems and consider intervention schemes requirements to manage MASS system related certificates The MASS System Administrator (operational level) is able regarding using and applying (C/L 3) and analysing (C/L 4) 	5 5 5 C/L	MASS MASS MASS STCW
competences	 shore-based operators to monitor and control compliance with legislative requirements and measures concerning MASS systems regarding evaluating (C/L 5) and creating (C/L 6) to improve the human-machine interaction, especially to keep the situational awareness on a high level to apply classification cycles for MASS systems and consider intervention schemes requirements to manage MASS system related certificates The MASS System Administrator (operational level) is able regarding using and applying (C/L 3) and analysing (C/L 4) to use knowledge about shipboard personnel management and 	5 5 5 C/L	MASS MASS MASS STCW

Process M.2	General Management of MASS-ROC Systems		
Operational	to apply effective resource management	3	A-III/6
Level	to apply decision-making techniques	3	A-III/6
	to foster the teamwork and communication in the entire MASS team in ROC and at sea	5	MASS
	to enable teams to work coordinated in different distributed locations	5	MASS
	to identify behaviours of operators in distributed work locations	5	MASS
	to identify the level of situational awareness in a team of operators and to improve in case of loss of sufficient S/A	5	MASS
	to implement and improve systematic decision-making procedures in remote monitoring and control	5	MASS
	to identify too high workloads in the operator and MASS team and to reduce stress levels by appropriate measures	5	MASS
Additional	Ј.		
comments			

M.3 Risk Management in MASS-ROC-Systems

Process M.3	Risk Man	agement in MASS-	ROC-Systems	
Scope of	All types of MASS			
application	A) Dry Cargo – Containe	er Feeder – short sea	a	
	B) Ferry – RoPax – one	hour passage		
	C) Dry Cargo – Bulk Car	rier – long distances		
	MASS with crew on board			
	> Shipping company - c	perations		
	MASS without crew on boar	ď		
	> Remote Operation Ce	entre		
Process	To identify and assess risks ir	n the entire MASS ar	nd remote-control system	n
objectives				
Process	MASS operators in ROC	Level	in ROC	RACI
operators	 Senior Navigator 	> Management	> Planning station	R, A
	> Senior Engineer	> Management	> Planning station	R
Interfaces	> MASS System Administra			
	> MASS System Specialists		,)	
	> Shipping Companies - Op			
	> Shipping Companies - Ma	-		
Event: input	Starting with hazard identifica	tion (HAZID) in all fie	elds of operation	
Process	> Hazard and risk identificat	ion in all fields of a N	/ASS-system	
description	> Risk assessment			
	> Definition of mitigating me			
	> Implementation of measur			
	> Control of effectiveness of	measures		
Resources	Personnel:			
needed	> Manpower of operators ar	nd specialists		
	Equipment:			
	> n/a			
Regulations	According to the field of asses	ssment		
Event: output	Identified risks and implement	ed mitigating measu	ires	

Process M.3	Risk Management in MASS-ROC-Systems			
Required	The MASS Operator (Navigator, Engineer) (operational level) is	C/L	STCW	
competences	able			
Operators	regarding using and applying (C/L 3) and analysing (C/L 4)			
Operational	to use appropriate tools to identify and assess operational risks	4	MASS	
Level	in the operation of MASS			
	to determine measures to mitigate operational risks and to	4	MASS	
	implement them			
Required	The MASS Senior Operator (Navigator, Engineer)	C/L	STCW	
competences	(management level) is able			
Senior	regarding using and applying (C/L 3) and analysing (C/L 4)			
Operators	to identify hazards for the operations of a MASS system,	4	MASS	
Management	covering all technical, organisational, and human-related			
Level	aspects			
	to derive risks which may arise by operation of a remote- controlled MASS	4	MASS	
	to use appropriate tools to identify and assess operational risks in the operation of MASS	4	MASS	
	to determine measures to mitigate operational risks and to implement them	4	MASS	
	regarding evaluating (C/L 5) and creating (C/L 6)			
	to identify and evaluate risk levels and to determine	5	MASS	
	appropriate mitigation measures by applying systematic risk			
	management tools			
	to set measures in place to reduce risk	5	MASS	
	to manage risk mitigating activities	5	MASS	
Additional	Risk management is required in all functionalities including navigatio	n, engir	neering,	
comments	communication, or integration of humans.			

M.4 Quality Management of MASS-ROC-Systems

Process M.4	Management	of Quality of MASS-	ROC-Systems	
Scope of	All types of MASS			
application	A) Dry Cargo – Container	Feeder – short sea		
	B) Ferry – RoPax – one h	our passage		
	C) Dry Cargo – Bulk Carri	er – long distances		
	MASS with crew on board			
	> In Remote Operation C	Centre		
	MASS without crew on board	ł		
	> In Remote Operation C	Centre		
Process	To determine the quality stand	ards for safe operatio	ons with an available an	d
objectives	reliable system, to implement a	and continuously imp	rove them.	
Process	MASS operators in ROC	Level	in ROC	RACI
operators	> Senior Navigator	> Management	> Planning station	R, A
-	> Navigator	> Operational		С
	> Senior Engineer	> Management	> Planning station	R
	> Engineer	> Operational		С
	> System Administrator	> Operational		С
Interfaces	All relevant systems, equipmer	nt, persons	1	1

Process M.4	Management of Quality of MASS-ROC-Systems		
Event: input	Determined quality standards and management reviews		
Process description	 > Definition, implementation, and improvement of management sy (but not limited to) Quality of the MASS and ROC system Energy and climate aspects Environmental protection Safety and security systems Occupational health 	rstems,	such as
Resources	Personnel:		
needed	 Manpower of management, operators, and specialists Stakeholder's requirements Interested parties' expectations Equipment: Inputs of all systems, equipment is needed 		
Regulations	Entire regulatory framework		
Event: output	Transparency on all quality standards and a continuous improveme	nt	
Required competences	The MASS Senior Operator (Navigator, Engineer) on management level is able	C/L	STCW
MASS Senior	regarding using and applying (C/L 3) and analysing (C/L 4)		
Operators Management	 to apply all relevant management systems to determine objectives related to the required standards	3	MASS MASS
Level	to communicate the requirements with all stakeholders and interested parties	4	MASS
	 regarding evaluating (C/L 5) and creating (C/L 6) to determine the appropriate organisation and management of the named systems 	5	MASS
	 to set-up processes for continuous improvement to manage all relevant measures and activities to obtain the 	5	MASS
	determined objectives	5	MASS
	to conduct internal and external audits of MASS and ROC management systems	5	MASS
Required competences	The MASS Operator (Navigator, Engineer, System Administrator) on operational level is able	C/L	STCW
MASS Operators Operational	regarding knowledge (C/L 1) and understanding (C/L 2) to explain management systems for quality, energy, environmental protection, safety, and security	2	MASS
Level	<i>regarding using and applying (C/L 3) and analysing (C/L 4)</i> to set quality improving measures into place and to communicate them to all involved persons	3	MASS
Additional comments	The development and implementation of management systems is a concerning the entire MASS and ROC system in wider sense. It sha aspects as the operational system, environment, energy, safety, see human occupational health.	all conta	

Operational Core Processes

1 Voyage Planning & Control

1.1 Voyage Planning

Process 1.1		Voyage Planning				
Scope of	All types of MASS					
application	A) Dry Cargo – Container F	-eeder – short sea				
	B) Ferry – RoPax – one hour passage					
	C) Dry Cargo – Bulk Carrie					
	MASS with crew on board	i long diotanooo				
	 Remote Operation Cent 	ro				
	•	le				
	> On board of MASS					
	MASS without crew on board					
	> Remote Operation Cent					
Process	To plan and prepare a voyage th	hat a MASS can sa	Il it by specific col	nsidera	ation of	
objectives	automation requirements	1				
Process	MASS operators in ROC	Level	in ROC		RACI	
operators	> Senior Navigator	> Management	> Planning sta	ation	R, A	
	MASS operators on board	Level	On board			
	> Senior Navigator	> Management	> Planning sta	ation	С	
Interfaces	> Commercial office (booking of	cargo/pax), charter	ers			
	> Port authorities	0 1 <i>//</i>				
	 Port facility operators (termin 	als tuas stevedor	es pilots)			
	 Agencies 		oo, piloto,)			
Event: input	Cargo (type, amount) and port (I					
Event. Input		FOL, FOD)				
	Commercial data					
	Automated Port Facilities					
	Navigational Support Systems					
Process	Plan the voyage					
		quiromonto				
description	Arrangement for navigational re	quirements				
	> Getting passage permits					
	> Getting data transmission slo					
	 Ensuring of availability of navigational aid systems 					
	Arrangement of port and fairway facilities					
	> Gathering all port and pilotage information					
	> Arrangement for MASS-relat	ted AFS (automatic	facility services)			
	>					
Resources	Personnel		C	Crew	ROC	
needed	> Operators			Х	Х	
	Equipment:					
	> MASS IT-system			Х	х	
	 Port and passage informatio 	n		X	X	
Regulations	MASS regulations					
Regulations	International shipping law					
	Local shipping law					
Event: output	> Voyage schedule					
		la navigational fac	litico			
	> Passage permits and available	•				
	 Passage permits and available Available resources (to operative) 	•		acilities	s,)	
Required	- · ·	ate the MASS) in e	ach port (berth, fa	cilities C/L	s,) STCW	

Process 1.1	Voyage Planning		
MASS Senior	to apply international and national regulatory framework for	3	MASS
Navigator	MASS, ROC and shipping to plan and use automated facilities		
Management	and services at sea and in ports		
Level	to apply national and international regulatory framework for the shore-based operators	3	MASS
	to analyse the requirements for navigation and port operations	3	MASS
	to identify all possible restrictions for MASS system on the	4	MASS
	specific planned voyage		
	to plan schedules for MASS voyages	5	MASS
Required	The MASS Senior Engineer (management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS Senior	to apply international and national regulatory framework for	3	MASS
Engineer Management	MASS, ROC, and shipping to plan, and use automated facilities and services at sea and in ports		
Level	to apply national and international regulatory framework for the shore-based operators	3	MASS
Additional comments	Commercial tasks will be done in the operations department of the s company. Expertise of navigators is required for specific technical co interfaces for autonomous operation.	•••	•

1.2 Voyage Monitoring & Control

Process 1.2	Voy	age Monitoring & (Control		
Scope of	All types of MASS				
application	A) Dry Cargo – Containe	er Feeder – short sea	3		
	B) Ferry – RoPax – one	B) Ferry – RoPax – one hour passage			
	C) Dry Cargo – Bulk Carrier – long distances				
	MASS with crew on board				
	> Remote Operation Ce	entre			
	> On board of MASS				
	MASS without crew on boar	ď			
	> Remote Operation Ce	entre			
Process	To ensure correct functioning	of the sensors and t	he automation and thus a	a safe	
objectives	operation of the MASS system	า			
Process	MASS operators in ROC	Level	in ROC	RACI	
operators	> Navigator	> Operational	> Monitoring station	R	
	> Senior Navigator	> Management	> Direct control st.	R, A	
	> Engineer	> Operational	> Monitoring station	R	
	> Senior Engineer	> Management	> Direct control st.	R	
	MASS operators on board	Level	on board	RACI	
	> Senior Navigator	> Management	 Direct control st. 	R, A	
	> Navigator	> Operational	> Monitoring station	R	
	> Engineer	> Operational	> Monitoring station	R	
Interfaces	> MASS System Administrat	tor			
	> MASS System Specialists	(e.g. IT, automation	,)		
Event: input	> All data (e.g. Sensor Data,	, Objectives, Decisio	ns) of the automation sys	stem	



Process 1.2	Voyage Monitoring & Control					
Process	Monitor the correct functioning of all systems of the MASS automation					
description	 Assess correct functioning of sensor system and MASS Situational awareness (MASS SA) 					
	> Assess correct functioning of automated navigation syste	m and a	ssocia	ited		
	interpretation of SA Information and Decision Making unit	t				
	 Assess correct functioning of automated control system 					
		 Assess correct functioning of autonomous communication system 				
	> Assess correct functioning of autonomous emergency res	sponse s	system	l		
	Take over control if MASS automation reaches its limitations					
Resources	Personnel	Cre		ROC		
needed	> Manpower of operators, and specialists	Х		X		
	Equipment:	V		v		
	 MASS automation system (including all systems, data & state of actuators) 	Х		Х		
Regulations	MASS flag state regulations					
	MASS local coastal and port state regulations					
	Radiocommunication regulations					
Event: output	> Correct functioning of the automation of the MASS is valid					
	 In cases correct functioning cannot be ensured, control is Navigator 	taken o	ver by	the		
Required	The MASS Navigator (operational level) is able		C/L	STCW		
competences	regarding knowledge (C/L 1) and understanding (C/L 2)					
MASS	to understand the basics of automation and control techn	iques	2	MASS		
Navigator	to explain and consider the limitations and conditions of		2	MASS		
Operational	automation and control techniques					
Level	to discuss the objectives and systems of the automation		2	MASS		
	to discuss the basics of automation and control systems		2	MASS		
	to explain the limitations of automation, e.g. in challenging	g	2	MASS		
	traffic situations or weather conditions					
	regarding using and applying (C/L 3) and analysing (C/L 4)					
	to monitor the automation and check whether the automa objectives are being met	ition	4	MASS		
	to intervene if critical deviations and situations occur		4	MASS		
	to monitor and interpret the sensor data of the MASS (tak proper outlook)	ke a	4	MASS		
	to assess the reliability of sensor values		4	MASS		
	to interpret aggregated information of automation and con techniques appropriately	ntrol	4	MASS		
	to assess interdependencies between different elements information	of	4	MASS		
	to interpret errors and critical situations correctly (e.g. esp when dealing with subsequent errors)	pecially	4	MASS		
	to communicate as part of a MASS system with other sta	tions	4	MASS		
	 by using standardised phrases to monitor the communication of the MASS with ROC and automated navigational aids or systems 	ł	4	MASS		
Required	The MASS Senior Navigator (mgmt. level) is able		C/L	STCW		
competences	regarding evaluating (C/L 5) and creating (C/L 6)					
MASS Senior Navigator	to take over direct control of the MASS (get quickly into the and adapt quickly to the situation and the vessel involved	•	5	MASS		
Management Level	to adjust and change parameters of the automation		5	MASS		

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Process 1.2	Voyage Monitoring & Control			
Required	The MASS Engineer (operational level) is able	C/L	STCW	
competences	regarding knowledge (C/L 1) and understanding (C/L 2)			
MASS	as Navigator		MASS	
Engineer	regarding using and applying (C/L 3) and analysing (C/L 4)			
Operational	as Navigator		MASS	
Level	regarding evaluating (C/L 5) and creating (C/L 6)			
	as Navigator		MASS	
Required	The MASS Senior Engineer (management level) is able	C/L	STCW	
competences	regarding evaluating (C/L 5) and creating (C/L 6)			
MASS Senior	to take over direct control of the MASS (get quickly into the loop	5	MASS	
Engineer	and adapt quickly to the situation and the vessel involved)			
Management	to change parameters of the automation			
Level	to identify and evaluate consequences of changes in the	5	MASS	
	voyage	5	MASS	
Additional	./.			
comments				

1.3 Voyage Tracking

Process 1.3		Voyage Tracking	l		
Scope of	All types of MASS				
application	> Dry Cargo – Container	Feeder – short sea			
	> Ferry – RoPax – one hour passage				
	> Dry Cargo – Bulk Carri	er – long distances			
	MASS with crew on board				
	> Remote Operation Cer	ntre			
	> On board of MASS				
	MASS without crew on board	l			
	> Remote Operation Cer	ntre			
Process	To observe the voyage and to r	manage changes			
objectives					
Process	MASS operators in ROC	Level	in ROC		RACI
operators	> Senior Navigator	> Management	> Planning	station	R, A
	MASS operators on board	Level	On board		
	> Senior Navigator	> Management	> Planning	station	C
Interfaces	> Commercial office (booking	cargo/pax), charter	ers		
	> Port authorities				
	> Port facility operators (termi	inals, tugs, stevedo	res, pilots, …)		
	> Agencies				
Event: input	> Changes in voyage schedu	le			
	> Changes in passage permit	s and available nav	igational facilit	ies	
	> Change in available resource	· · ·	rth, facilities,	.)	
Process	> Observe the status of MAS	S			
description	> Observe for deviations in vo				
	> Manage changes of voyage	e parameters			
Resources	Personnel			Crew	ROC
needed	> Manpower of management	, operators, and spe	ecialists	Х	X
	Equipment:				
	> Commercial IT-system				X
	> Navigational systems (ECD	IS, radar, AIS, sour	nder,)	Х	X



Process 1.3	Voyage Tracking				
	 Information systems (publications, MIS, forecasts, traffic information) 	Х	X		
	> Sensor data (MASS status)	Х	X		
Regulations	International regulations MASS flag state regulations Local port regulations				
Event: output	 Revised voyage schedule with all changes of required capability 	oilities and	facilities		
Required competences	The MASS Senior Navigator (management level) is able regarding using and applying (C/L 3) and analysing (C/L 4)	C/L	STCW		
MASS Senior	to apply the regulating framework for operations of MASS	3	MASS		
Navigator	to use automated facilities and services at sea and in ports	3	MASS		
Management Level	to analyse the requirements for navigation and port operatio regarding evaluating (C/L 5) and creating (C/L 6)	ns 4	MASS		
	to identify all possible restrictions for MASS system on the specific planned voyage	5	MASS		
	to plan schedules for MASS	5	MASS		
	to identify and evaluate consequences of changes in the voyage	5	MASS		
Additional	In general, most of required competences are the same as in pr	ocess 1.1	Voyage		
comments	Planning				

1.4 Voyage Documentation and Analysis

Process 1.4	Voyage	Documentation ar	nd Analysis				
Scope of	All types of MASS						
application	> Dry Cargo – Containe	> Dry Cargo – Container Feeder – short sea					
	> Ferry – RoPax – one	> Ferry – RoPax – one hour passage					
	> Dry Cargo – Bulk Car	rier – long distances	3				
	MASS with crew on board	-					
	> Remote Operation Ce	entre					
	> On board of MASS						
	MASS without crew on boar	d					
	> Remote Operation Ce	entre					
Process	To collect all relevant data and	d to analyse it for im	provement of the MASS	system			
objectives							
Process	MASS operators in ROC	Level	in ROC	RACI			
operators	> Senior Navigator	> Management	 Planning station 	R, A			
	> Senior Engineer	> Management	 Planning station 	R			
	> System Administrator	> Operational	> System control st.	R			
	MASS operators on board	Level	on board	RACI			
	> Senior Navigator	> Management	 Planning station 	R, C			
Interfaces	> MASS systems		·				
Event: input	Data of all MASS systems						
Process	> Continuous collecting and	gathering of voyage	e related data and inform	ation			
description	> Checking data and information	ation quality					
	> Analysing data						
	> Storage of data and inform	nation continuously					

Process 1.4	Voyage Documentation and Analysis	-	
Resources	Equipment in ROC and on board	Crew	ROC
needed	> Navigational systems (ECDIS, radar, AIS, sounder,)	Х	X
	> Information systems (publications, MIS, forecasts, traffic	Х	X
	information)		
	 Sensor data (MASS status) 	Х	X
	> IT storage and analysis systems		X
Regulations	International regulations		
	MASS flag state regulations		
	Local port regulations		
Event: output	Electronic logbooks with status and performance data for all op	erational is	sues,
	such as for example:		
	> Navigation and deck		
	> Propulsion and machinery		
	 Safety and security 		
	> MASS status and performance		
Required	The MASS Operators (navigator and engineer on operation	al C/L	STCW
competences	level) is able …		
MASS	regarding using and applying (C/L 3) and analysing (C/L 4)		
Operators	to document and file operational data	3	MASS
Operational	to analyse data indicating performance, availability, and	d 4	MASS
Level	reliability of all MASS systems		
	to determine data being relevant for operation of a MAS		MASS
	i.e. parameters reflecting operational states of all releva	ant	
	systems on a MASS		
	to optimise data for evaluation purposes	4	MASS
	to save all data and information of the MASS system	3	MASS
	to prepare regular status reports from operational data	4	MASS
Required	The MASS Senior Navigator (on management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS Senior	to determine relevant data for operation of a MASS, i.e	. 4	MASS
Navigators	parameters reflecting operational states of all relevant		
Management	systems on a MASS		
Level	to use software tools for data analysis	3	MASS
	to use digital platforms	3	MASS
	to determine and measure standards of performance o	fa 4	MASS
	MASS system		
	to map applications and hardware of automation system	ns 4	MASS
	to field level, control level, or supervisory level respecti	vely	
	("Automation Pyramid")	-	
	regarding evaluating (C/L 5) and creating (C/L 6)		
	to evaluate performance, reliability, and availability of a	II 5	MASS
	MASS and ROC subsystems		
	to structure and evaluate collected data and informatio	n 5	MASS
	to derive baselines and thresholds for equipment from	5	MASS
	operating data that may be used for generating meanir	igful	
	alarms and events	-	
	to derive information to analyse the MASS system	5	MASS
	to control the performance of a MASS system	5	MASS
	to evaluate the reliability of automation and control		
	· · · · · · · · · · · · · · · · · · ·	1	
	systems	5	MASS



Process 1.4	Voyage Documentation and Analysis		
	to optimise operations of MASS by using digital twins	5	MASS
		5	MASS
Required	The MASS Senior Engineer (on management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS Senior	to determine data being relevant for operation of a MASS,	4	MASS
Engineers	i.e. parameters reflecting operational states of all relevant		
Management	systems on a MASS		
Level	to use software tools for data analysis	3	MASS
	to use digital platforms	3	MASS
	to analyse the automatic control systems by diagnostic	4	MASS
	applications		
	to analyse automatic control systems by using digital twins	4	MASS
	to use robotic systems for inspections on MASS	3	MASS
	to evaluate performance, reliability, and availability of all	4	MASS
	MASS and ROC subsystems		
	to map applications and hardware of automation systems	4	MASS
	to field level, control level, or supervisory level respectively		
	("Automation Pyramid")		
	regarding evaluating (C/L 5) and creating (C/L 6)		
	to evaluate the performance of auxiliary and machinery	5	MASS
	automatic controlled systems		
	to evaluate the performance of propulsion automatic	5	MASS
	controlled systems		
	to evaluate the remote-control system for integrity and	5	MASS
	reliability		
	to determine and measure standards of performance of a	5	MASS
	MASS system		
	to structure and evaluate collected data and information	5	MASS
	to derive baselines and thresholds for equipment from	4	MASS
	operating data that may be used for generating meaningful	5	MASS
	alarms and events		
	to derive information to analyze the MASS evotor	5	MASS
	to control the performance of a MASS system	5	MASS
	the second sector of the second s	5	MASS
	to evaluate the reliability of automation and control systems		
	to derive information to analyse the MASS system	5	MASS
	to optimise operations of MASS by using digital twins	5	MASS
Required	The MASS System Administrator (operational level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS	to document and file operational data	3	MASS
System	to analyse data indicating performance, availability, and	4	MASS
Administrator	reliability of all MASS systems		
Operational	to determine data being relevant for operation of a MASS,	4	MASS
Level	i.e. parameters reflecting operational states of all relevant		
	systems on a MASS		
	to optimise data for evaluation purposes	4	MASS
	to save all data and information of the MASS system	3	MASS
	to prepare regular status reports from operational data	4	MASS
	regarding evaluating (C/L 5) and creating (C/L 6)	.	
	to determine and measure standards of performance of a	5	MASS
	MASS system		
		5	MASS

Process 1.4	Voyage Documentation and Analysis		
	to evaluate performance, reliability and availability of all		
	MASS and ROC subsystems	5	MASS
	to structure and evaluate collected data and information		
Additional	Л.		
comments			

2 Cargo Operations

2.1 Cargo & Persons Embarkation Planning and Preparation

Process 2.1	Cargo & Persons E	mbarkation Plann	ing and Preparation		
Scope of	All types of MASS				
application	> Dry Cargo – Container Feeder – short sea				
	> Ferry – RoPax – one hour passage				
	> Dry Cargo – Bulk Carrie	er – long distances			
	MASS with crew on board	-			
	> Remote Operation Cen	tre			
	MASS without crew on board				
	> Remote Operation Cen	tre			
Process	Ensure a safe loading of the MA				
objectives	Ensure a safe embarkation of p	ersons (passengers	s, maintenance and serv	/ice	
-	crew, ship crew)				
Process	MASS operators in ROC	Level	in ROC	RACI	
operators	> Senior Navigator	> Management	> Planning station	R, A	
	> Navigator	> Operational	> Planning station	С	
Interfaces	> Shipping company - operation	•	-		
	> Terminal, stevedores, port f				
Event: input	Cargo to be loaded				
	Persons to be embarked				
Process	Cargo handling and stowage				
description	 Identification of cargoes, an 	d planning of loadir	ng and stowage plans		
A) Feeder	 Identification and planning of 		• • •	ardo	
C) Bulker	 Identification and planning of 			al go	
	 Planning of securing of carg 	•	•		
	Ship condition		L .		
	 Planning preparation of the 	ship for loading of a	cardo		
	 Preparation of cargo holds a 		•		
	Operation of ship	and localing oquipin	ont		
	 Planning of ship stability, trip 	m and strength inclu	uding ballasting		
Process	Cargo handling and stowage	in and calongar mon	ading ballability		
description	 Identification of vehicles and 	d planning of loadin	a		
B) Ferry	 Identification and planning of 		•	ardo	
	 Planning of securing of vehi 		logation of dangerous of	al go	
	Ship condition				
	 Planning of preparation of the 	ne ship for loading o	of vehicles and persons		
	embarkation	1 5	I		
	Operation of ship and care for p	persons			
	> Planning of persons boardir				
	> Planning of ship stability and	-			
Resources	Personnel	5			
needed	 Manpower of terminal 				
	Equipment:				
	 MASS technical specification 	ns (ship, holds. hat	ch covers, loading and		
	discharging equipment,)	(₁ -,, ,, ,,	_, g d		
	 Stability calculator 				
	 Loading and Stability Manual 	al.			
	 Cargo Securing Manual, 	,			
	 Cargo information, stowage 	plans			
		Piano			

Process 2.1	Cargo & Persons Embarkation Planning and Preparat	tion			
	> Ship operational data (bunker, ballast, provisions)				
Regulations	International regulations (SOLAS, CSS, IMDG, IMSBC,)				
	MASS flag state regulations				
	Local port regulations				
	Occupational health and accident prevention regulations				
Event: output	Plan of loading and embarkation,				
	Loading and boarding operations are prepared and can start.				
Required	The MASS Navigator (operational level) is able	C/L	STCW		
competences	regarding knowledge (C/L 1) and understanding (C/L 2)				
MASS	to explain the ship construction to maintain seaworthiness of	2	A-II/1		
Navigator	the ship	_			
Operational	to describe different types of MASS and their specific	2	MASS		
Level	constructional differences	_			
	to explain the handling of cargo on a MASS, e.g. as container, break bulk, bulk, liquid, or Ro-Ro-cargo	2	MASS		
	to describe requirements of specific missions of MASS, e.g. as in research, offshore, or dredging operations	2	MASS		
	to explain the control of persons on board of a MASS	2	MASS		
	regarding using and applying (C/L 3) and analysing (C/L 4)	-			
	to explain and apply stability issues to maintain seaworthiness	3	A-II/1		
	of the ship				
	to control trim, stability, and stress by using tables, diagrams,	3	A-II/1		
	and stress-calculating equipment				
	to use remote controlled or autonomous systems to control	3	MASS		
	stability, trim, and stress				
	to use remotely controlled or autonomous pumping systems for	3	MASS		
	liquids (ballast water, fuels,) and to control remotely tank				
	filling				
	to monitor remote the ship stability, trim, and stress	3	MASS		
Required	The MASS Senior Navigator (management level) is able	C/L	STCW		
competences	regarding knowledge (C/L 1) and understanding (C/L 2)				
MASS Senior	explain tankers and tanker operations	2	A-II/2		
Navigator	regarding using and applying (C/L 3) and analysing (C/L 4)				
Management	to consider compliance with legislative requirements ensuring	4	A-II/2		
Level	safe cargo handling (as CSS-Code, IMDG-Code, IMSBC-				
	Code, MARPOL, accident prevention)				
	regarding evaluating (C/L 5) and creating (C/L 6)				
	to plan a safe loading and stowage, taking all cargo properties	5	A-II/2		
	into account				
	to plan a safe securing of cargoes	5	A-II/2		
	to plan trim, stability, and stress by using tables, diagrams, and automatic data-based equipment	5	A-II/2		
	to plan and set the parameters for stability conditions of a	5	MASS		
	MASS passage	_			
	to control trim, stability, and stress in regard of fundamental	5	A-II/2		
	principles of ship construction, theories, and affecting factors	_			
	to plan the carriage of dangerous cargo according to IMDG and IMSBC Codes	5	A-II/2		
	to plan and control automated cargo and mission operations	5	MASS		
	to evaluate the stability and reliability of the MASS	5	MASS		
	to evaluate the reliability of the remote stability control system	5	MASS		
	, , , , , , , , , , , , , , , , , , , ,				



Process 2.1	Cargo & Persons Embarkation Planning and Preparation			
	to plan procedures and control of passengers and other	5	MASS	
	persons on board of a MASS to ensure a safe carriage			
Additional	All three use cases of the study require the same competences.			
comments	The task of cleaning the holds of a bulk carrier is not covered by this process and needs a riding crew unless technologies for cargo hold cleaning are available			

2.2 Cargo Loading & Persons Embarkation

Process 2.2	Cargo Loa	ading & Persons En	nbarkation	
Scope of	All types of MASS			
application	> Dry Cargo – Container	Feeder – short sea		
	> Ferry – RoPax – one h	our passage		
	> Dry Cargo – Bulk Carri	er – long distances		
	MASS with crew on board			
	> Remote Operation Cer	ntre		
	MASS without crew on board	l		
	> Remote Operation Cer	ntre		
Process	Operate a safe loading of the M	IASS		
objectives	Operate a safe embarkation of	persons (passengers	s, maintenance and ser	vice
	crew, ship crew)			
Process	MASS operators in ROC	Level	in ROC	RACI
operators	> Senior Navigator	> Management	> Cargo control st.	R, A
	> Navigator	> Operational	> Cargo control st.	R
Interfaces	> Shipping company - operati	ions, charterer, ship p	blanner	
	> Terminal operators, steved	ores, port facilities		
	> Auditors	-		
Event: input	Start of cargo loading or persor	ns embarkation		
Process	Cargo handling and stowage			
description	> Monitor and control loading	operations		
A) Feeder	> Monitor and control securin	g operations		
B) Ferry	> Monitor for cargo damages	and document if any		
C) Bulker	Ship condition			
	> Prepare loading systems (e	.g. hatch covers, ran	nps, doors conveyors, .)
	> Prepare gangways and ship	o-shore-connections	to MASS	
	> Check MASS and equipme	nt for defects and da	mages	
	Operation of ship and care for	persons		
	> Ensuring security (ISPS)			
	> Confirming cargo loaded in	the documentation		
	> Boarding and counting of cr	rew and passengers		
	> Ballasting when loading, co	ntrol of stability, trim,	and stress	
	> Monitor ship-shore-connect	ions		
Resources	Personnel			
needed	> Manpower of terminal			
	Equipment			
	> MASS technical specification	ons (ship, holds, hatc	h covers, loading and	
	discharging equipment,)			
	> Stability calculator,			
	> Loading and Stability Manu	al,		
	> Cargo Securing Manual,			
	> Cargo information,			
	> Ship operational data (bunk	ker, ballast, provision	s)	

Process 2.2	Cargo Loading & Persons Embarkation				
Regulations	International regulations (SOLAS, CSS, IMDG, IMSBC,)				
	MASS flag state regulations				
	Local port regulations				
	Occupational health and accident prevention regulations				
Event: output	End of loading and embarkation, all cargo without any damages and	l perso	ns		
	safely on board				
Required	The MASS Navigator (operational level) is able	C/L	STCW		
competences	regarding knowledge (C/L 1) and understanding (C/L 2)				
MASS	to explain the ship construction to maintain seaworthiness of	2	A-II/1		
Navigator	the ship				
Operational	regarding using and applying (C/L 3) and analysing (C/L 4)				
Level	to explain and apply stability issues to maintain seaworthiness of the ship	3	A-II/1		
	to monitor a safe loading and stowage	3	A-II/1		
	to monitor cargo securing	3	A-II/1		
	to inspect and report defects and damages to cargo spaces,	3	A-II/1		
	hatch covers, and ballast tanks				
	to monitor compliance with legislative requirements	3	A-II/1		
	to monitor cargo or mission related equipment by remote	3	MASS		
	control				
	to monitor the interfaces of the MASS to terminal and port	3	MASS		
	operations				
	to support cargo or mission operations by providing all required	3	MASS		
	information to other parties involved				
	to monitor persons (crew and passengers) on the MASS	3	MASS		
	to monitor and check specific MASS systems (automated	3	MASS		
	berthing systems, ship-shore-connections, cargo operation				
	remote monitoring systems)				
	to understand and monitor person identification and counting	3	MASS		
	devices to control access to the MASS				
	to inspect a MASS for structural damages and report these	4	MASS		
	when the MASS is in the port.				
Required	The MASS Senior Navigator (management level) is able	C/L	STCW		
competences	regarding using and applying (C/L 3) and analysing (C/L 4)				
MASS Senior	to consider compliance with legislative requirements ensuring	4	A-II/2		
Navigator	safe cargo handling (as CSS-Code, IMDG-Code, IMSBC-				
Management	Code, MARPOL, IS-Code, accident prevention)				
Level	regarding evaluating (C/L 5) and creating (C/L 6)				
	to ensure and operate a safe loading and stowage, taking all	5	A-II/2		
	cargo properties into account				
	to ensure a safe securing and handling of cargoes	5	A-II/2		
	to control trim, stability, and stress by using tables, diagrams,	5	A-II/2		
	and automatic data-based equipment				
	to control trim, stability, and stress in regard of fundamental	5	A-II/2		
	principles of ship construction, theories, and affecting factors				
	to assess reported defects and damage to cargo spaces, hatch	5	A-II/2		
	covers, and ballast tanks and take appropriate action				
	to load dangerous cargo according to IMDG and IMSBC	5	A-II/2		
	Codes	_			
	to evaluate the stability and reliability of the remote stability	5	MASS		
	control system	_			
	to evaluate the stability and reliability of the MASS	5	MASS		

Process 2.2	Cargo Loading & Persons Embarkation		
	to evaluate the reliability of the remote stability control system	5	MASS
	to handle luggage and personal effects safely	5	MASS
	to perform remote inspections of the structure and deck equipment	3	MASS
	to evaluate defects or damages of a MASS	5	MASS
	to initiate corrective measures to ensure safe cargo and mission operations	5	MASS
	regarding communication and cooperation to establish effective communication and working relationship between ship and terminal personnel	5	A-11/2
	to coordinate all activities to control stability, trim, and strength of a MASS	5	MASS
Additional comments	The required competences regarding to the loading and boarding protection the same for each MASS use case. The differences are determined provisions.		

2.3 Cargo Care & Persons Control at Sea

Process 2.3	Cargo Ca	are & Persons Cont	rol at Sea		
Scope of	All types of MASS				
application	 > Dry Cargo – Container Feeder – short sea 				
	> Ferry – RoPax – one h	our passage			
	> Dry Cargo – Bulk Carri	er – long distances			
	MASS with crew on board				
	> Remote Operation Cer	ntre			
	MASS without crew on board	1			
	> Remote Operation Cer	ntre			
Process objectives	Safe carriage of cargo and per	sons on board			
Process	MASS operators in ROC	Level	in ROC	RACI	
operators	> Senior Navigator	> Management	> Cargo control st.	R, A	
	> Navigator	> Operational	> Cargo control st.	R	
Interfaces	> Shipping company, Fleet O	peration Centre	·		
Event: input	Commence of voyage				
Process	Cargo care				
description	> Monitoring of cargo, securir	ng of containers			
A) Feeder	> Monitoring of dangerous ca	irgo			
C) Bulker	> Monitoring of temperatures	of bulk cargoes and	reefer containers		
	> Control of ventilation of care	go holds			
	Control of persons on board				
	> Monitoring of persons on bo	oard such as riding c	rew		
	> Monitoring of ambient cond	itions in accommoda	tions		
	> Providing provisions, servic	es, and accommoda	tion		
Process	Cargo care				
description	> Monitoring of cargo, securir	ng of vehicles			
B) Ferry	> Control of ventilation of care	go holds			
	Control of persons on board				
	> Monitoring of persons on be		-	-	
	> Monitoring of ambient cond	itions in accommoda	tions and public spaces	\$	

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Process 2.3	Cargo Care & Persons Control at Sea		
	 Providing of provisions and convenience services 		
	> Cleaning and hygienic services		
Resources	Personnel		
needed	> Manpower of ratings and service crew		
	Equipment		
	> Cargo information		
Degulations	> Ship operational data (bunker, ballast, provisions)		
Regulations	International regulations (SOLAS, CSS, IMDG, IMSBC,) MASS flag state regulations		
	Occupational health and accident prevention regulations		
Event: output	No damages of cargo and safely disembarked persons		
	No damages of cargo and salely disembarked persons		
Required	The MASS Navigator (operational level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS	to use remote controlled or autonomous systems to control	3	MASS
Navigator	stability, trim, and stress		
Operational	to use remotely controlled or autonomous pumping systems for	3	MASS
Level	liquids (ballast water, fuels, …) and to remotely control tank		
	filling	_	
	to monitor remote the ship stability, trim, and stress	3	MASS
<u> </u>	to apply and monitor sensor-based cargo monitoring systems	3	MASS
Required	The MASS Senior Navigator (management level) is able	C/L	STCW
competences MASS Senior	regarding evaluating (C/L 5) and creating (C/L 6)	F	A-II/2
	to ensure safe stowage, securing, and care during the voyage	5 5	A-11/2 A-11/2
Navigator Management	to care about dangerous cargo according to IMDG and IMSBC Codes	5	A-11/2
Level	to control trim, stability, and stress in regard of fundamental	5	A-II/2
Level	principles of ship construction, theories, and affecting factors		/\-II/Z
	to take care of cargo and missions on a MASS when at sea	5	MASS
	and to initiate all required remote-controlled activities for a safe		
	shipment or execution of tasks		
	to evaluate the stability and reliability of the remote stability	5	MASS
	control system		
	to evaluate the stability and reliability of the MASS	5	MASS
	to evaluate remotely hazards to the MASS in the seaway, the	5	MASS
	cargo, and persons on board, and to establish appropriate		
	measures		
	to evaluate remotely hazards to the cargo and persons on	5	MASS
	board, and to establish appropriate measures	_	
	to control persons and passengers, and monitor passengers	5	MASS
	on board remotely	F	MACC
	to evaluate the behaviour of persons on board by remote	5	MASS
	observations	4	MASS
	to establish a communication between ROC and MASS areas with persons on board	-	
	to even include the even for new one and needed new on heard of	4	MASS
	the MASS		
	to monitor passenger and accommodation areas to ensure	4	MASS
	safety of persons		
Additional	The care of persons on board of a ferry needs a service crew		
comments			

2.4 Cargo Discharging & Persons Disembarkation

Process 2.4	Cargo Discha	rging & Persons Di	sembarkation					
Scope of	All types of MASS							
application	 > Dry Cargo – Container Feeder – short sea 							
	> Ferry – RoPax – one h	our passage						
	> Dry Cargo – Bulk Carrier – long distances							
	MASS with crew on board	Ū						
	 Remote Operation Centre 							
	MASS without crew on board							
	 Remote Operation Cent)					
Process	Operate a safe discharging of t							
objectives	Operate a safe disembarkation		ers, maintenance and	service				
objectivec	crew, ship crew)	er percene (pacceng		0011100				
Process	MASS operators in ROC	Level	in ROC	RACI				
operators	 Senior Navigator 	> Management	 Cargo control st. 	R, A				
operators		 Operational 	 Cargo control st. Cargo control st. 	R				
Interfaces								
Interfaces	> Shipping company - operation Terminal exercises atoyoda		Janner					
	> Terminal operators, stevedo	fres, port facilities						
E	> Auditors							
Event: input	Start of cargo discharging or pe	ersons disembarkatio	n					
Process	Cargo handling							
description	> Monitor and control prepara							
A) Feeder	> Monitor and control discharge	ging operations						
B) Ferry	Ship condition							
C) Bulker	> Prepare loading systems (e	.g. hatch covers, ram	nps, doors, conveyors,)				
	> Prepare gangways and ship	-shore-connections	to MASS					
	> Check MASS and equipment	nt for defects and da	mages					
	Operation of ship and care for persons							
	Operation of ship and care for p	persons	-					
	 Operation of ship and care for p Ensuring security (ISPS) 	persons	-					
			passengers					
	> Ensuring security (ISPS)	of leaving crew and						
	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co 	of leaving crew and ntrol of stability, trim,						
Resources	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co 	of leaving crew and ntrol of stability, trim,						
Resources	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel 	of leaving crew and ntrol of stability, trim,						
	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal 	of leaving crew and ntrol of stability, trim,						
	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment 	of leaving crew and ntrol of stability, trim, ions	and stress					
	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification 	of leaving crew and ntrol of stability, trim, ions	and stress					
	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification discharging equipment,) 	of leaving crew and ntrol of stability, trim, ions	and stress					
	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification discharging equipment,) > Stability calculator 	of leaving crew and ntrol of stability, trim, ions ons (ship, holds, hatc	and stress					
	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification discharging equipment,) > Stability calculator > Loading and Stability Manu 	of leaving crew and ntrol of stability, trim, ions ons (ship, holds, hatc	and stress					
	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification discharging equipment,) > Stability calculator > Loading and Stability Manu > Cargo Securing Manual, 	of leaving crew and ntrol of stability, trim, ions ons (ship, holds, hatc	and stress					
	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification discharging equipment,) > Stability calculator > Loading and Stability Manu > Cargo Securing Manual, > Cargo information, 	of leaving crew and ntrol of stability, trim, ions ons (ship, holds, hatc al,	and stress h covers, loading and					
needed	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification discharging equipment,) > Stability calculator > Loading and Stability Manu > Cargo Securing Manual, > Ship operational data (bunk 	of leaving crew and ntrol of stability, trim, ions ons (ship, holds, hatc al,	and stress h covers, loading and s)					
	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification discharging equipment,) > Stability calculator > Loading and Stability Manu > Cargo Securing Manual, > Cargo information, > Ship operational data (bunk International regulations (SOLA) 	of leaving crew and ntrol of stability, trim, ions ons (ship, holds, hatc al,	and stress h covers, loading and s)					
needed	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification discharging equipment,) > Stability calculator > Loading and Stability Manu > Cargo Securing Manual, > Cargo information, > Ship operational data (bunk International regulations (SOLA MASS flag state regulations 	of leaving crew and ntrol of stability, trim, ions ons (ship, holds, hatc al,	and stress h covers, loading and s)					
needed	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification discharging equipment,) > Stability calculator > Loading and Stability Manu > Cargo Securing Manual, > Cargo information, > Ship operational data (bunk International regulations (SOLA MASS flag state regulations 	of leaving crew and ntrol of stability, trim, ions ons (ship, holds, hatc al, er, ballast, provisions	and stress h covers, loading and s) BC,)					
needed	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification discharging equipment,) > Stability calculator > Loading and Stability Manuel > Cargo Securing Manual, > Cargo information, > Ship operational data (bunkel International regulations (SOLA MASS flag state regulations Local port regulations Occupational health and accided 	of leaving crew and ntrol of stability, trim, ions ons (ship, holds, hatc al, er, ballast, provisions S, CSS, IMDG, IMS	and stress h covers, loading and s) BC,)					
needed	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification discharging equipment,) > Stability calculator > Loading and Stability Manu > Cargo Securing Manual, > Cargo information, > Ship operational data (bunk International regulations (SOLA MASS flag state regulations 	of leaving crew and ntrol of stability, trim, ions ons (ship, holds, hatc al, er, ballast, provisions S, CSS, IMDG, IMS	and stress h covers, loading and s) BC,)	persons				
needed	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification discharging equipment,) > Stability calculator > Loading and Stability Manu > Cargo Securing Manual, > Cargo information, > Ship operational data (bunk International regulations (SOLA MASS flag state regulations Local port regulations Occupational health and accide End of discharging and disemb 	of leaving crew and ntrol of stability, trim, ions ons (ship, holds, hatc al, er, ballast, provision S, CSS, IMDG, IMS ent prevention regula arking all cargo witho	and stress h covers, loading and s) BC, …) tions put any damages and p	persons				
needed Regulations Event: output Required	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification discharging equipment,) > Stability calculator > Loading and Stability Manu > Cargo Securing Manual, > Cargo information, > Ship operational data (bunk International regulations (SOLA MASS flag state regulations Local port regulations Occupational health and accided End of discharging and disemb safely from board The MASS Navigator (operational context) 	of leaving crew and ntrol of stability, trim, ions ons (ship, holds, hatc al, er, ballast, provisions S, CSS, IMDG, IMS ent prevention regular arking all cargo witho	and stress h covers, loading and s) BC,) tions but any damages and p					
needed Regulations Event: output	 > Ensuring security (ISPS) > Disembarking and counting > Ballasting when loading, co > Monitor ship-shore-connect Personnel > Manpower of terminal Equipment > MASS technical specification discharging equipment,) > Stability calculator > Loading and Stability Manuel > Cargo Securing Manual, > Cargo information, > Ship operational data (bunk International regulations (SOLA MASS flag state regulations Local port regulations Occupational health and accided End of discharging and disemb safely from board 	of leaving crew and ntrol of stability, trim, ions ons (ship, holds, hatc al, er, ballast, provisions S, CSS, IMDG, IMS ent prevention regular arking all cargo witho onal level) is able onal level) is able	and stress h covers, loading and s) BC,) tions but any damages and p <i>C/L</i> <i>2</i>)					

Process 2.4	Cargo Discharging & Persons Disembarkation		
Operational	regarding using and applying (C/L 3) and analyzing (C/L 4)		
Level	to explain and apply stability issues to maintain seaworthiness	3	A-II/1
	of the ship		
	to monitor a safe unloading	3	A-II/1
	to monitor cargo un-securing	3	A-II/1
	to inspect and report defects and damages to cargo spaces,	3	A-II/1
	hatch covers and ballast tanks		A-II/1
	to monitor compliance with legislative requirements	3	A-II/1
	to monitor cargo or mission related equipment by remote control	3	MASS
	to monitor the interfaces of the MASS to terminal and port operations	3	MASS
	to support cargo or mission operations by providing all required information to other parties involved	3	MASS
	to monitor persons (crew and passengers) on the MASS	3	MASS
	to monitor and check specific MASS systems (automated	3	MASS
	berthing systems, ship-shore-connections, cargo operation remote monitoring systems)	_	
	to use remote controlled or autonomous systems to control stability, trim, and stress	3	MASS
	to use remotely controlled or autonomous pumping systems for liquids (ballast water, fuels,), and to control remotely tank	3	MASS
	filling	3	MASS
	to monitor remote the ship stability, trim, and stress	4	MASS
	to inspect a MASS for structural damages and report these when the MASS is in the port.	4	IVIAGO
Required	The MASS Senior Navigator (management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)	0/L	31000
MASS Senior	to consider compliance with legislative requirements ensuring	4	A-II/2
Navigator	safe cargo handling (as CSS-Code, IMDG-Code, IMSBC-	-	7-11/2
Management	Code, MARPOL, IS-Code, accident prevention)		
Level			
Level	regarding evaluating (C/L 5) and creating (C/L 6)	F	A 11/0
	to ensure and operate a safe discharging, taking all cargo	5	A-II/2
	properties into account	F	
	to ensure a safe un-securing and handling of cargoes	5	A-II/2
	to control trim, stability, and stress by using tables, diagrams	5	A-II/2
	and automatic data-based equipment	-	
	to control trim, stability, and stress in regard of fundamental	5	A-II/2
	principles of ship construction, theories, and affecting factors	-	
	to evaluate the stability and reliability of the MASS	5	MASS
	to evoluate the validbility of the versets stability control evolutions	- E	MASS
	to evaluate the reliability of the remote stability control system	5	
	to assess reported defects and damage to cargo spaces, hatch	5 5	A-II/2
	to assess reported defects and damage to cargo spaces, hatch covers, and ballast tanks, and take appropriate action	5	A-II/2
	to assess reported defects and damage to cargo spaces, hatch		A-11/2 A-11/2
	 to assess reported defects and damage to cargo spaces, hatch covers, and ballast tanks, and take appropriate action to discharge dangerous cargo according to IMDG and IMSBC 	5	A-II/2
	 to assess reported defects and damage to cargo spaces, hatch covers, and ballast tanks, and take appropriate action to discharge dangerous cargo according to IMDG and IMSBC Codes to evaluate the stability and reliability of the remote stability control system to handle luggage and personal effects safely 	5 5	A-11/2 A-11/2
	 to assess reported defects and damage to cargo spaces, hatch covers, and ballast tanks, and take appropriate action to discharge dangerous cargo according to IMDG and IMSBC Codes to evaluate the stability and reliability of the remote stability control system 	5 5 5	A-11/2 A-11/2 MASS



Process 2.4	Cargo Discharging & Persons Disembarkation		
	to coordinate all activities o control stability, trim and strength	5	MASS
	of a MASS		
Additional	The required competences regarding the loading and boarding proce	ess are	e the
comments	same for each MASS use case. The differences are determined by the cargo		
	provisions.		

3 Navigation

3.1 Navigation when Leaving Port

3.1.1 Passage Planning

Process 3.1.1	Navigation when	Leaving Port - Passa	age Plannir	ng	
Scope of	All types of MASS				
application	A) Dry Cargo – Container Feeder – short sea				
	B) Ferry – RoPax – one hour passage				
	C) Dry Cargo – Bulk Carrie	r – long distances			
	MASS with crew on board				
	> Remote Operation Cent	re			
	MASS without crew on board				
	> Remote Operation Cent	re			
Process	To prepare a passage plan from	berth to berth			
objectives					
Process	MASS operators in ROC	Level in	ROC		RACI
operators	> Senior Navigator	> Management >	Planning	station	R, A
	> Navigator	> Operational >	Planning	station	С
	> Senior Engineer	> Management >	Planning	station	R
Interfaces	> Shipping company - operation				
	> Navigational data provider (v			5,)	
Event: input	Order to sail from the port of dep	parture to the port of de	stination		
Process	Plan the passage :				
description	> Prepare the passage plan (w		ed)		
	> Determine and plan specific				
	 Consider environmental cond 	•			
	 Determine communication re 				
	> Update all navigational data as electronic navigational charts, nautical				
	publications, MSI,				
	 Check availability of navigation 	onal systems and plan	probable re	equired	
	maintenance				
	> Confirmation and release of	passage plan by MASS	6 Master or	Supervi	sor
Resources	Equipment:				
needed	> Navigational systems, e.g., E	ECDIS			
	> Publications				
	Information and Data:				
	> Voyage schedule				
	 Navigational data, MIS, weather forecasts 				
	> Data for updating of navigational systems (charts, publications)				
	> MASS status (navigational, p	propulsion, persons on	board, drau	ıght,)	
Regulations	International regulations (COLREG,)				
-	MASS flag state traffic regulation				
	Local port state and coastal state				
Event: output	Prepared and approved passage	-			
Required	The MASS Navigator (operation	nal level) is able		C/L	STCW
competences	regarding knowledge (C/L 1) and	d understanding (C/L 2)		
MASS	to understand radar and ARI	PA regarding performa	nce, use,	2	A-II/1
Navigator	types and limitations				



Process 3.1.1	Navigation when Leaving Port - Passage Planni	ng	
Operational	to understand ECDIS regarding capabilities and limitations	2	A-II/1
Level	regarding using and applying (C/L 3) and analysing (C/L 4)		
	to plan a passage by applying terrestrial and coastal	3	A-II/1
	navigation		
	to plan a passage by using electronic systems	3	A-II/1
	to plan a passage by using and interpreting meteorological	4	A-II/1
	information		
	to prepare a passage plan	3	A-II/1
	to use radar and ARPA to maintain safety of navigation	3	A-II/1
	to operate radar navigation by interpreting and analysing	4	A-II/1
	radar and ARPA information		
	to operate ECDIS by interpreting and analysing of	4	A-II/1
	information obtained from ECDIS		
	to plan a passage with consideration of MASS relevant	4	MASS
	communication and data transfer demands		
	to plan a passage with consideration of MASS relevant	4	MASS
	navigational aids		
	to prepare all navigational and communication systems of a	4	MASS
	MASS for operation, as updates and settings		
Required	The MASS Senior Navigator (management level) is able	C/L	STCW
competences	regarding evaluating (C/L 5) and creating (C/L 6)		
MASS Senior	to plan a passage for all conditions by using all acceptable	5	A-II/2
Navigator	methods of plotting ocean tracks		
Management	to determine positions and assess accuracy of the resultant	5	A-II/2
Level	position fix by terrestrial observations		
	to determine positions and assess accuracy of the resultant	5	A-II/2
	position fix by modern electronic navigational aids		
	to establish watchkeeping arrangements and procedures	5	A-II/2
	to maintain safe navigation through the use of information	5	A-II/2
	from navigation equipment and systems to assist command		
	decision making		
	to maintain the safety of navigation through the use of	5	A-II/2
	ECDIS and associated navigation systems to assist		
	command decision making		
	to forecast weather and oceanographic conditions	5	A-II/2
	to evaluate and release a passage plan for a MASS	5	MASS
	to evaluate provided navigational data and information with	5	MASS
	respect to the demands of a MASS		
Required	The MASS Senior Engineer (management level) is able	C/L	STCW
competences	regarding evaluating (C/L 5) and creating (C/L 6)		
MASS Senior	to plan a passage of a MASS with specific evaluation and	5	MASS
Engineer	consideration of energy consumption		
Management	to plan a passage of a MASS with specific evaluation and	5	MASS
Level	consideration of availability of propulsion and auxiliary		
20101	systems		
Additional			
comments	d.		
commenta			

3.1.2 Departure / De-Berthing

Process 3.1.2	Navigation when Leaving Port - Departure / De-Berthing				
Scope of	All types of MASS				
application	A) Dry Cargo – Container Feeder – short sea				
	B) Ferry – RoPax – one hour passage				
	C) Dry Cargo – Bulk Carrier – long distances				
	MASS with crew on board				
	> Remote Operation Centre				
	MASS without crew on board				
	> Remote Operation Cer	ntre (direct control)			
Process	To leave the berth safely and t	o start pilotage			
objectives					
Process	MASS operators in ROC	Level	in ROC		RACI
operators	> Senior Navigator	> Management	> Direct contro	ol st.	R, A
	> Navigator	> Operational	> Direct contro		C
Interfaces	 Navigational data provider 	· ·			
Internation	 Port control 			,	
	 Local port AFS, Local port 	facilities			
	 Local pilot (remote or on bo 				
Event: input	Order for departure	alu)			
Process	Prepare leaving berth -> 'ready	, to go'			
		-	ana and controls	fan :m4	a anita (
description	> Check systems and maintain and and and and and and and and and an		ems and controls	tor int	egrity
	and availability for de-berth	ling			
	> Get port clearance				
	> Ensure watertight integrity				
	> Check for all people from b		d service crew on	board	
	> Change to autonomous op				
	 Disconnect all in autonomo 	ous or manual mode (power, water, fue	el,	
	gangway,)				
	Leaving				
	> Monitor the MASS manoeu				
	> Change to direct control if it	required by system o	r situation or envi	ronme	ntal
	conditions				
	> Let-go all (release MASS, s				
	> Incorporate pilot (on board	•	1		
	> Manoeuvre MASS to fairway	ау			
Resources	Equipment on board				
needed	> Navigational systems (ECE	DIS, radar, AIS, sound	der, specific positi	ioning	
	system,)				
	> Information systems (publications, MIS, forecasts, traffic information)				
	> Sensor data (MASS status))			
Regulations	International regulations (COL	REG,)			
	MASS flag state traffic regulations				
	Local port state and coastal sta	ate traffic regulations			
Event: output	MASS is de-berthed and is in p	position to start pilota	ge		
Required	The MASS Navigator (operat	ional level) is able		C/L	STCW
competences	regarding knowledge (C/L 1) a	•			
MASS	to understand radar and Al	÷ .	,	2	A-II/1
Navigator	types, and limitations	0 01	, ,		-
Operational	to understand ECDIS regarding capabilities and limitations 2 A-II/1				
Level	to explain the manoeuvring and handling of a ship 2 A-II/1				

Process 3.1.2	Navigation when Leaving Port - Departure / De-Berthing			
	to discuss the application of MASS-specific systems and their	2	MASS	
	use for autonomous ships			
	to explain the handling of a MASS regarding the mooring	2	MASS	
	equipment and the use of automated port facilities			
	regarding using and applying (C/L 3) and analysing (C/L 4)			
	to conduct a passage and determine a position by using	3	A-II/1	
	electronic systems			
	to conduct a passage and determine a position by using echo-	3	A-II/1	
	sounders			
	to conduct a passage and determine a position by using	3	A-II/1	
	magnetic and gyro compasses			
	to conduct a passage by using and adjusting steering control	3	A-II/1	
	systems			
	to conduct a passage by using and interpreting meteorological	4	A-II/1	
	information			
	to maintain a safe navigational watch by analysing traffic	4	A-II/1	
	situations and applying the international Regulations for			
	Preventing Collisions at Sea			
	to maintain a safe navigational watch by using all equipment,	3	A-II/1	
	provisions, information, regulations, principles, techniques, and			
	procedures for watchkeeping			
	to maintain a safe navigational watch by applying bridge	3	A-II/1	
	resource management principles			
	to use radar and ARPA to maintain safety of navigation	4	A-II/1	
	to operate radar navigation by interpreting and analysing radar	4	A-II/1	
	and ARPA information		• • • •	
	to operate ECDIS by interpreting and analysing of information	4	A-II/1	
	obtained from ECDIS	_	MA 00	
	to operate the navigational and communication system of a	3	MASS	
	MASS	2	MASS	
	to explain the handling of a MASS regarding the mooring	2	IVIA33	
	equipment and the use of automated port facilities	3	MASS	
	to use specific navigational aids for MASS	4	MASS	
	to use remotely all navigational tools to verify and assess the	4	IVIA33	
	MASS position, course, and speed	4	MASS	
	to interpret remotely the environmental conditions and to verify	-		
	and assess the status of the MASS in the sea	4	MASS	
	to monitor and operate the data and information exchange	-		
	between MASS and all relevant stations	4	MASS	
	to monitor and operate sensor systems by interpretation and	т 		
	analysing reliability of provided information to monitor the automated functionalities of a MASS	4	MASS	
		4	MASS	
	to analyse and adjust automated systems in terms of	'		
	navigational parameters	4	MASS	
	to take over the manual control from automated systems in all	'		
Poquirod	situations	C//	STOW	
Required	The MASS Senior Navigator (management level) is able	C/L	STCW	
competences MASS Senior	regarding evaluating (C/L 5) and creating (C/L 6)	5	A-II/2	
Navigator	to determine positions and assess accuracy of resultant	0	A-11/2	
Management	position fix by terrestrial observations to determine positions and assess accuracy of the resultant	5	A-II/2	
Level	to determine positions and assess accuracy of the resultant position fix by modern electronic navigational aids			
LEVEI				
Process 3.1.2	Navigation when Leaving Port - Departure / De-Berthing			
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	to determine and allow for compass errors (magnetic and gyro)	5	A-II/2	
	to establish watchkeeping arrangements and procedures			
	to maintain safe navigation through the use of information from	5	A-II/2	
	navigation equipment and systems to assist command decision making	5	A-II/2	
	to maintain the safety of navigation through the use of ECDIS	5	A-II/2	
	and associated navigation systems to assist command decision making			
	to forecast weather and oceanographic conditions	5	A-II/2	
	to manoeuvre and handle a ship in all conditions, especially	5	A-II/2	
	when unberthing or undocking and when using tugs			
	to manoeuvre and handle a ship in all conditions, especially	5	A-II/2	
	manoeuvring in restricted and shallow waters			
	to take over the command by changing from automated to manual mode of a MASS	5	MASS	
	to communicate remotely with port services when berthing or unberthing	4	MASS	
	to berth and unberth a MASS based on sensor data	5	MASS	
	to handle a MASS safely in all manoeuvres as berthing, anchoring, fairway and sea passages	5	MASS	
	to handle a MASS according to environmental influences	5	MASS	
	to evaluate and ensure the data and information exchange between MASS and all relevant stations	5	MASS	
	to evaluate the reliability of data and information provided by sensor systems	5	MASS	
	to coordinate and adjust the different automated functionalities of a MASS	5	MASS	
	to analyse and adjust automated systems in terms of navigational parameters	5	MASS	
Additional	./.			
comments				

3.2 Navigation on Pilotage - Outbound

Process 3.2	Naviga	tion on Pilotage - O	utbound	
Scope of	All types of MASS			
application	A) Dry Cargo – Containe	r Feeder – short sea		
	B) Ferry – RoPax – one ł	nour passage		
	C) Dry Cargo – Bulk Carr	ier – long distances		
	MASS with crew on board			
	> Remote Control Centr	e		
	MASS without crew on board	d		
	> Remote Control Centr	e (direct control)		
Process	To navigate the MASS safely t	hrough restricted wa	ters in pilotage condition	s
objectives				
Process	MASS operators in RCC	Level	in RCC	RACI
operators	> Senior Navigator	> Management	> Direct control st.	R, A
-	> Navigator	> Operational	> Direct control st.	R
Interfaces	> Navigational data provider	(weather forecasts, e	electronic charts, navigat	ional
	aids,)			
	> Port control			



Process 3.2	Navigation on Pilotage - Outbound		
	> Local port AFS, Local port facilities		
	> Local pilot (remote or on board)		
	> Other ships, VTS		
Event: input	Commence of pilotage		
Process	Navigate the MASS through restricted waters:		
description	 Change to autonomous mode and monitor the MASS condit 	ions	
	> Monitor position of MASS and water depth		
	> Monitor the traffic situation		
	> Monitor the movement of the MASS and identify influences	such a	s by
	currents, wind impact squat, interactions, etc		
	> Change to direct control if required by system, situation, or ended	environ	mental
	conditions		
	 Incorporate the pilot (on board or remotely) and take pilots a coordinate with MASS system 	advice,	
Resources	Equipment on board		
needed	 Navigational systems (ECDIS, radar, AIS, sounder, local positior 	nina sv	stems
)		,
	> Information systems (publications, MIS, forecasts, traffic informa	tion)	
	> Sensor data (MASS status)	,	
Regulations	International regulations (COLREG,)		
	MASS flag state traffic regulations		
	Local port state and coastal state traffic regulations		
Event: output	End of pilotage outbound, commence of sea passage		
Required	The MASS Navigator (operational level) is able	C/L	STCW
competences	regarding knowledge (C/L 1) and understanding (C/L 2)		
MASS	to understand radar and ARPA regarding performance, use,	2	A-II/1
Navigator	types, and limitations		
Operational	to understand ECDIS regarding capabilities and limitations	2	A-II/1
Level	to explain the manoeuvring and handling of a ship	2	A-II/1
	to explain the navigational and communication system of a MASS	2	MASS
	regarding using and applying (C/L 3) and analysing (C/L 4)		
	to conduct a passage and determine a position by applying	2	MASS
	terrestrial and coastal navigation		
	to conduct a passage and determine a position by using electronic systems	3	A-II/1
	to conduct a passage and determine a position by using echo-	3	A-II/1
	sounders		
	to conduct a passage and determine a position by using	3	A-II/1
	magnetic and gyro compasses		
	to conduct a passage by using and adjusting steering control	3	A-II/1
	systems		
	to conduct a passage by using and interpreting meteorological	3	A-II/1
	information	A	A-II/1
	to maintain a safe navigational watch by analysing traffic	4	A-II/ I
	situations and applying the international Regulations for		
	Preventing Collisions at Sea	4	A-II/1
	to maintain a safe navigational watch by using all equipment, provisions, information, regulations, principles, techniques, and	-	/ \=11/ 1
	procedures for watchkeeping		
	procedures for waterineeping	1	l

Process 3.2	Navigation on Pilotage - Outbound		
	to maintain a safe navigational watch by applying bridge	3	A-II/1
	resource management principles		
	to use radar and ARPA to maintain safety of navigation	3	A-II/1
	to operate radar navigation by interpreting and analysing radar and ARPA information	3	A-II/1
	to operate ECDIS by interpreting and analysing of information obtained from ECDIS	4	A-II/1
	to apply collision-avoidance regulations for a MASS	4	MASS
	to use specific navigational aids for MASS	3	MASS
	to use all navigational tools remotely to verify and assess the MASS position, course and speed	4	MASS
	to interpret the environmental conditions remotely and to verify and assess the status of the MASS in the sea	4	MASS
		4	MASS
		4	MASS
	manoeuvring parameters of the MASS	4	MASS
	To take-over control according to levels of alarm	4	MASS
	to monitor and operate the data and information exchange between MASS and all relevant stations		
	to monitor cellular and satellite communication networks	4	MASS
	to monitor and operate sensor systems by interpretation and analysing reliability of provided information	4	MASS
	to monitor the automated functionalities of a MASS	4	MASS
	to analyse and adjust automated systems in terms of navigational parameters	4	MASS
	to take control from automated systems according to alarm levels	4	MASS
Required	The MASS Senior Navigator (management level) is able	C/L	STCW
competences	regarding evaluating (C/L 5) and creating (C/L 6)		
MASS Senior	to determine positions and assess accuracy of resultant	5	A-II/2
Navigator	position fix by terrestrial observations		
Management	to determine positions and assess accuracy of resultant	5	A-II/2
Level	position fix by modern electronic navigational aids		
	to determine and allow for compass errors (magnetic and gyro)	5	A-II/2
	to establish watchkeeping arrangements and procedures	5	A-II/2
	to maintain safe navigation through the use of information from navigation equipment and systems to assist command decision	5	A-II/2
	making to maintain the safety of navigation through the use of ECDIS and associated navigation systems to assist command decision	5	A-II/2
	making	5	
	to forecast weather and oceanographic conditions	5 5	A-II/2 A-II/2
	to manoeuvre and handle a ship in all conditions, especially	5	A-11/2
	when unberthing or undocking, and when using tugs to manoeuvre and handle a ship in all conditions, especially	5	A-II/2
	manoeuvring in restricted and shallow waters to take over command by changing from automated to manual	5	MASS
	mode of a MASS	F	MAGO
	to manoeuvre a MASS based on sensor data	5	MASS
	to evaluate and ensure the data and information exchange	5	MASS
	between MASS and all relevant stations		

Process 3.2	Navigation on Pilotage - Outbound		
	to evaluate the reliability of data and information provided by sensor systems	5	MASS
	to coordinate and adjust the different automated functionalities of a MASS	5	MASS
	to analyse and adjust automated systems in terms of navigational parameters	5	MASS
Additional	Л.		
comments			

3.3 Navigation on Sea Passage

Process 3.3	Navigation on Sea Passage
Scope of	All types of MASS
application	A) Dry Cargo – Container Feeder – short sea
	B) Ferry – RoPax – one hour passage
	C) Dry Cargo – Bulk Carrier – long distances
	MASS with crew on board
	> Remote Control Centre
	MASS without crew on board
	 Remote Control Centre (monitoring station)
Process	To navigate the MASS safely on the sea passage in monitoring conditions
objectives	
Process	MASS operators in RCC Level in RCC RAC
operators	> Senior Navigator > Management > Monitoring station R, A
	> Navigator > Operational > Monitoring station R
Interfaces	> Navigational data provider (weather forecasts, electronic charts, navigational
	aids, …)
	> Other ships, VTS
Event: input	Commence of sea passage
Process	Navigate the MASS through open sea:
description	 Navigate in autonomous mode and monitor the MASS conditions
	> Monitor the state of the MASS fleet and the single MASS, change to single
	MASS if required (alarms, conditions, checks)
	> Monitor the state of all sensors and operate checks of critical systems
	> Monitor that the MASS system keeps within set limitations
	> Change parameters and settings of the MASS system as appropriate to
	keep the MASS in required operational conditions
	 Change to direct communication with other stations if required by
	navigational situations
	 Change to a direct control station if required by system or situation or
	environmental conditions
	 Identify malfunctions and arising emergency situations and alert direct
	control stations and experts to take over
Resources	Equipment on board
needed	 Navigational systems (ECDIS, radar, AIS, sounder, local positioning systems,)
	 Information systems (publications, MIS, forecasts, traffic information)
	 Sensor data (MASS status)
	,

Process 3.3	Navigation on Sea Passage		
Regulations	International regulations (COLREG,)		
	MASS flag state traffic regulations		
	Local coastal state traffic regulations		
Event: output	End of sea passage, change to pilotage inbound		
Required	The MASS Navigator (operational level) is able	C/L	STCW
competences	regarding knowledge (C/L 1) and understanding (C/L 2)	0,2	0.01
MASS	to understand radar and ARPA regarding performance, use,	2	A-II/1
Navigator	types, and limitations		
Operational	to understand ECDIS regarding capabilities and limitations	2	A-II/1
Level	to explain the manoeuvring and handling of a ship	2	A-II/1
	to explain the navigational and communication system of a MASS	2	MASS
	to explain the handling of a MASS regarding the mooring equipment and the use of automated port facilities	2	MASS
	<i>regarding using and applying (C/L 3) and analysing (C/L 4)</i> to conduct a passage and determine a position by applying	3	A-II/1
	terrestrial and coastal navigation to conduct a passage and determine a position by using	3	A-II/1
	electronic systems to conduct a passage and determine a position by using echo-	3	A-II/1
	sounders to conduct a passage and determine a position by using	3	A-II/1
	magnetic and gyro compasses to conduct a passage by using and adjusting steering control	3	A-II/1
	systems to conduct a passage by using and interpreting meteorological	4	A-II/1
	information to maintain a safe navigational watch by analysing traffic	4	A-II/1
	situations and applying the international Regulations for Preventing Collisions at Sea		
	to maintain a safe navigational watch by using all equipment, provisions, information, regulations, principles, techniques, and procedures for watchkeeping	3	A-II/1
	to maintain a safe navigational watch by applying bridge resource management principles	3	A-II/1
	to use radar and ARPA to maintain safety of navigation	3	A-II/1
	to operate radar navigation by interpreting and analysing radar and ARPA information	4	A-II/1
	to operate ECDIS by interpreting and analysing of information obtained from ECDIS	4	A-II/1
	to monitor and operate the data and information exchange between MASS and all relevant stations	4	MASS
	to apply collision-avoidance regulations for a MASS	4	MASS
	to use specific navigational aids for MASS	4	MASS
	to use all navigational tools remotely to verify and assess the	4	MASS
	MASS position, course and speed to interpret the environmental conditions remotely and to verify	4	MASS
	and assess the status of the MASS in the sea	3	MASS
	to use specific navigational aids for MASS	4	MASS
	to use all navigational tools remotely to verify and assess the MASS position, course and speed		



Process 3.3	Navigation on Sea Passage		
	to interpret the environmental conditions remotely and to verify	4	MASS
	and assess the status of the MASS in the sea		
	to monitor cellular and satellite communication networks	4	MASS
	to monitor and operate sensor systems by interpretation and	4	MASS
	analysing reliability of provided information		
	to monitor the automated functionalities of a MASS	4	MASS
	to analyse and adjust automated systems in terms of	4	MASS
	navigational parameters		
	to take over control from automated systems according to	4	MASS
	alarm levels		
Required	The MASS Senior Navigator (management level) is able	C/L	STCW
competences	regarding evaluating (C/L 5) and creating (C/L 6)		
MASS Senior	to determine positions and assess accuracy of resultant	5	A-II/2
Navigator	position fix by terrestrial observations		
Management	to determine positions and assess accuracy of resultant	5	A-II/2
Level	position fix by modern electronic navigational aids		
	to determine and allow for compass errors (magnetic and gyro)	5	A-II/2
	to establish watchkeeping arrangements and procedures	5	A-II/2
	to maintain safe navigation through the use of information from	5	A-II/2
	navigation equipment and systems to assist command		
	decision making		
	to maintain the safety of navigation through the use of ECDIS	5	A-II/2
	and associated navigation systems to assist command		
	decision making		
	to forecast weather and oceanographic conditions	5	A-II/2
	to manoeuvre and handle a ship in all conditions	5	A-II/2
	to take over the command by changing from automated to	5	MASS
	manual mode of a MASS		
	to manoeuvre a MASS based on sensor data	5	MASS
	to evaluate and ensure the data and information exchange	5	MASS
	between MASS and all relevant stations		
	to evaluate the reliability of data and information provided by	5	MASS
	sensor systems		
	to coordinate and adjust the different automated functionalities	5	MASS
	of a MASS		
	to analyse and adjust automated systems in terms of	5	MASS
	navigational parameters		
Additional	J.		
comments			

3.4 Navigation on Pilotage - Inbound

Process 3.4	Navigation on Pilotage - Inbound
Scope of	All types of MASS
application	A) Dry Cargo – Container Feeder – short sea
	B) Ferry – RoPax – one hour passage
	C) Dry Cargo – Bulk Carrier – long distances
	MASS with crew on board
	> Control Centre
	MASS without crew on board
	 Remote Control Centre (direct control)

Process 3.4	Navigation on Pilotage - Inbound			
Process	To navigate the MASS safely through restricted waters in pilotage conditions			
objectives			1	
Process	MASS operators in RCC	Level	in RCC	RACI
operators	> Senior Navigator	> Management	> Direct control s	
	> Navigator	> Operational	> Direct control s	
Interfaces	 > Navigational data provide aids,) > Port control > Local port AFS, Local port > Local pilot (remote or on the > Other ships, VTS 	t facilities	lectronic charts, navi	gational
Event: input	Commence of pilotage			
Process	Navigate the MASS through i	restricted waters:		
description	 Monitor position of MASS Monitor the traffic situatio Monitor the movement of wind impact squat, interact Change to direct control in conditions Incorporate the pilot (on b with MASS system 	n the MASS and identify ctions f required by system or	situation or environ	nental
Resources	with MASS system Equipment on board			
needed	 Navigational systems (EC) Information systems (pub Sensor data (MASS statu 	lications, MIS, forecast s)		-
Regulations	International regulations (CO MASS flag state traffic regula Local port state and coastal s	tions		
Event: output	Arrival at berth, start of moori	-		
Required	The MASS Navigator (opera	ational level) is able	. C/	STCW
competences	regarding knowledge (C/L 1)	•		
MASS	to understand radar and A	÷ .	,	A-II/1
Navigator	types, and limitations			
Operational	to understand ECDIS reg	• •		A-II/1
Level	to explain the manoeuvrir	• •	•	A-II/1
	to explain the navigationa MASS			MASS
	regarding using and applying		. ,	
	to conduct a passage and terrestrial and coastal nav	-	by applying 3	A-II/1
	to conduct a passage and electronic systems	determine a position	by using 3	A-II/1
	to conduct a passage and sounders	determine a position l	by using echo- 3	A-II/1
	to conduct a passage and magnetic and gyro compa	•	by using 3	A-II/1
	to conduct a passage by systems		eering control 3	A-II/1
	eyetenne			



Process 3.4	Navigation on Pilotage - Inbound		
	to maintain a safe navigational watch by analysing traffic situations and applying the international Regulations for	4	A-II/1
	Preventing Collisions at Sea		
	to maintain a safe navigational watch by using all equipment,	3	A-II/1
	provisions, information, regulations, principles, techniques, and		
	procedures for watchkeeping	2	A 11/4
	to maintain a safe navigational watch by applying bridge	3	A-II/1
	resource management principles to use radar and ARPA to maintain safety of navigation	3	A-II/1
	to use radar and ARPA to maintain safety of navigation to operate radar navigation by interpreting and analysing radar	4	A-II/1
	and ARPA information		
	to operate ECDIS by interpreting and analysing of information obtained from ECDIS	4	A-II/1
	to monitor and operate the data and information exchange between MASS and all relevant stations	4	MASS
	to apply collision-avoidance regulations for a MASS	4	MASS
	to use specific navigational aids for MASS	4	MASS
	to use all navigational tools remotely to verify and assess the	4	MASS
	MASS position, course and speed		
	to interpret the environmental conditions remotely and to verify	4	MASS
	and assess the status of the MASS in the sea	0	
	to use specific navigational aids for MASS	3	MASS
	to use all navigational tools remotely to verify and assess the	4	MASS
	MASS position, course and speed to interpret the environmental conditions remotely and to verify	4	MASS
	to interpret the environmental conditions remotely and to verify and assess the status of the MASS in the sea		11// 100
	to monitor cellular and satellite communication networks	4	MASS
	to monitor and operate sensor systems by interpretation and	4	MASS
	analysing reliability of provided information		
	to monitor the automated functionalities of a MASS	4	MASS
	to analyse and adjust automated systems in terms of navigational parameters	4	MASS
	to take over the control from automated systems according to alarm levels	4	MASS
Required	The MASS Senior Navigator (management level) is able	C/L	STCW
competences	regarding evaluating (C/L 5) and creating (C/L 6)		
MASS Senior Navigator	to determine positions and assess accuracy of resultant position fix by terrestrial observations	5	A-II/2
Management Level	to determine positions and assess accuracy of resultant position fix by modern electronic navigational aids	5	A-II/2
	to determine and allow for compass errors (magnetic and gyro)	5	A-II/2
	to establish watchkeeping arrangements and procedures	5	A-II/2
	to maintain safe navigation through the use of information from	5	A-II/2
	navigation equipment and systems to assist command decision making		
	to maintain the safety of navigation through the use of ECDIS	5	A-II/2
	and associated navigation systems to assist command		
	decision making	5	A-II/2
	 to forecast weather and oceanographic conditions to manoeuvre and handle a ship in all conditions, especially	5	A-11/2 A-11/2
	to manoeuvre and handle a ship in all conditions, especially when un-berthing or un-docking and when using tugs	Ŭ	

Process 3.4	Navigation on Pilotage - Inbound		
	to manoeuvre and handle a ship in all conditions, especially	5	A-II/2
	manoeuvring in restricted and shallow waters		
	to take over command by changing from automated to manual	5	MASS
	mode of a MASS		
	to manoeuvre a MASS based on sensor data	5	MASS
	to evaluate and ensure the data and information exchange	5	MASS
	between MASS and all relevant stations		
	to evaluate the reliability of data and information provided by	5	MASS
	sensor systems		
	to coordinate and adjust the different automated functionalities	5	MASS
	of a MASS		
	to analyse and adjust automated systems in terms of	5	MASS
	navigational parameters		
Additional	Л.		·
comments			

3.5 Navigation when Entering the Port

3.5.1 Anchoring

Process 3.5.1	Navigation when Entering the Port - Anchoring						
Scope of	All types of MASS	Faadar abartaaa					
application	 A) Dry Cargo – Container Feeder – short sea B) Ferry – RoPax – one hour passage C) Dry Cargo – Bulk Carrier – long distances 						
	MASS with crew on board	C) Dry Cargo – Bulk Carrier – long distances					
	 Remote Operation Cen 	tre					
	MASS without crew on board						
	> Remote Operation Cen	tre (direct control)					
Process	To anchor the MASS in waiting	· · ·					
objectives	_						
Process	MASS operators in ROC	Level	in ROC	RACI			
operators	 Senior Navigator 	 Management 	> Direct control st.	R, A			
	> Navigator	 Operational 	> Direct control st.	С			
Interfaces	> Navigational data provider (weather forecasts, el	lectronic charts,)				
	> VTS, port control						
	> Local pilot (remote or on bo	ard)					
Event: input	Order for anchoring						
Process	Prepare anchoring and drop an	chor:					
description	> Check and maintain sta		and controls for integrity	y and			
	availability for mooring	•					
	 Change to direct control 						
	> Incorporate pilot if requ		'				
	> Prepare anchoring syst	•	o drop				
	> Drop anchor and check	the holding					
	Anchor watch						
	 Monitor anchor position and surrounding traffic Monitor communication with VTS, pilots, and other ships 						
	 Change to direct control conditions 	•	•	nmental			



Process 3.5.1	Navigation when Entering the Port - Anchoring				
	Heaving anchor and proceeding				
	> Prepare anchoring system for heaving anchor				
	 Monitor the manoeuvre in direct control condition 				
	 Secure anchors when manoeuvre is finished 				
	> Change to appropriate control mode to continue with the particular sector of the particular	ssage			
Resources	Equipment				
needed	> Navigational systems (ECDIS, radar, AIS, sounder, specific posi	tioning	system,		
)				
	 Information systems (publications, MIS, forecasts, traffic informa 	tion)			
	> Sensor data (MASS status)				
Regulations	International regulations (COLREG,)				
	MASS flag state traffic regulations				
	Local port state and coastal state traffic regulations				
Event: output	Anchors up and passage can be continued				
Required	The MASS Navigator (operational level) is able	C/L	STCW		
competences	regarding knowledge (C/L 1) and understanding (C/L 2)				
MASS	to explain the handling of a MASS regarding the anchoring	2	MASS		
Navigator	equipment				
Operational	regarding using and applying (C/L 3) and analysing (C/L 4)	0			
Level	to conduct a passage and determine a position by using	3	A-II/1		
	electronic systems	2	A 11/4		
	to conduct a passage and determine a position by using echo-	3	A-II/1		
	sounders	3	A-II/1		
	to conduct a passage and determine a position by using	3	A-11/ 1		
	magnetic and gyro compasses	3	A-II/1		
	to conduct a passage by using and adjusting steering control	3	A-11/ 1		
	systems to conduct a passage by using and interpreting meteorological	4	A-II/1		
	information	-	A-11/ 1		
	te presidente e este presidenti e el constale la consecto en el como de este este este este este este este e	4	A-II/1		
	situations and applying the international Regulations for		7.11/1		
	Preventing Collisions at Sea				
	to maintain a safe navigational watch by using all equipment,	3	A-II/1		
	provisions, information, regulations, principles, techniques, and		/		
	procedures for watchkeeping				
	to maintain a safe navigational watch by applying bridge	3	A-II/1		
	resource management principles				
	to use radar and ARPA to maintain safety of navigation	4	A-II/1		
	to operate radar navigation by interpreting and analysing radar	4	A-II/1		
	and ARPA information				
	to operate ECDIS by interpreting and analysing of information	4	A-II/1		
	obtained from ECDIS				
	to monitor and operate the data and information exchange	4	MASS		
	between MASS and all relevant stations				
	to use specific navigational aids for MASS	3	MASS		
	to use all navigational tools remotely to verify and assess the	4	MASS		
	MASS position, course and speed				
	to interpret the environmental conditions remotely and to verify	4	MASS		
	and assess the status of the MASS in the sea				
	to monitor and operate sensor systems by interpretation and	4	MASS		
	analysing reliability of provided information				
	to monitor the automated functionalities of a MASS	4	MASS		

Process 3.5.1	Navigation when Entering the Port - Anchoring				
	to analyse and adjust automated systems in terms of	4	MASS		
	navigational parameters				
	to take over control from automated systems according to	4	MASS		
	alarm levels				
Required	The MASS Senior Navigator (management level) is able	C/L	STCW		
competences	regarding evaluating (C/L 5) and creating (C/L 6)				
MASS Senior	to determine positions and assess accuracy of resultant	5	A-II/2		
Navigator	position fix by terrestrial observations				
Management	to determine positions and assess accuracy of resultant	5	A-II/2		
Level	position fix by modern electronic navigational aids				
	to determine and allow for compass errors (magnetic and gyro)	5	A-II/2		
	to establish watchkeeping arrangements and procedures	5	A-II/2		
	to maintain safe navigation through the use of information from	5	A-II/2		
	navigation equipment and systems to assist command				
	decision making				
	to maintain the safety of navigation through the use of ECDIS	5	A-II/2		
	and associated navigation systems to assist command				
	decision making				
	to forecast weather and oceanographic conditions	5	A-II/2		
	to manoeuvre and handle a ship in all conditions, especially	5	A-II/2		
	when anchoring				
	to manoeuvre and handle a ship in all conditions, especially	5	A-II/2		
	manoeuvring in restricted and shallow waters				
	to take over command by changing from automated to manual	5	MASS		
	mode of a MASS				
	to anchor a MASS based on sensor data	5	MASS		
	to handle a MASS safely in all manoeuvres as berthing,	5	MASS		
	anchoring, fairway and sea passages				
	to handle a MASS according to environmental influences	5	MASS		
	to evaluate and ensure the data and information exchange	5	MASS		
	between MASS and all relevant stations				
	to evaluate the reliability of data and information provided by	5	MASS		
	sensor systems				
	to coordinate and adjust the different automated functionalities	5	MASS		
	of a MASS				
	to analyse and adjust automated systems in terms of	5	MASS		
	navigational parameters				
Additional	This process can also be applied in other circumstances such as an	choring	g in		
comments	shelter positions or in case of malfunctions		-		

3.5.2 Arrival / Berthing

Process 3.5.2	Navigation when Entering the Port - Arrival / Berthing
Scope of	All types of MASS
application	D) Dry Cargo – Container Feeder – short sea
	E) Ferry – RoPax – one hour passage
	F) Dry Cargo – Bulk Carrier – long distances
	MASS with crew on board
	> Remote Control Centre
	MASS without crew on board
	> Remote Control Centre (direct control)



Process 3.5.2	Navigation when Enter	ing the Port - Arrival / Be	runng		
Process	To berth the MASS safel	y in the planned position			
objectives					
Process	MASS operators in RC	C Level	in RCC		RAC
operators	> Senior Navigator	> Management	> Direct contr	ol st.	R, A
	> Navigator	> Operational	> Direct contr		Ċ
Interfaces	-	vider (weather forecasts, e			
Interfaceo	 Port control 			,	
		I port facilition			
	> Local port AFS, Loca	-			
F	> Local pilot (remote or	,			
Event: input	MASS in position to start	mooring manoeuvre			
Process	Prepare mooring operation	ons:			
description		tain status of ship systems	and controls for i	integrit	v and
description		ooring operations		megin	y and
	-	•	vice		
		(on board or by remote ad	vice)		
	Mooring Manitor the man	a a wind of the MACC to th	a hauth		
		oeuvring of the MASS to th			
	•	control if required by syste	em or situation or	enviro	nmenta
	conditions	1 (1		`	
		sel fixing connections (line		s)	
		ver, water, fuel, gangway, .)		
	Arrival				
	> Check for all PAX and service crew from board				
	> Switch automation	on systems to port condition			
Resources	> Switch automation	on systems to port conditio	ns		
Resources needed	> Switch automation		ns	ioning	system
	 Switch automatic Equipment Navigational systems) 	on systems to port conditio (ECDIS, radar, AIS, sound	ns der, specific posit	-	system
	 Switch automatic Equipment Navigational systems) Information systems 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas	ns der, specific posit	-	system
	 Switch automatic Equipment Navigational systems) Information systems Sensor data (MASS sector) 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status)	ns der, specific posit	-	system
	 > Switch automatic Equipment > Navigational systems) > Information systems > Sensor data (MASS solutions) 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,)	ns der, specific posit	-	system
needed	 > Switch automatic Equipment > Navigational systems) > Information systems > Sensor data (MASS sensor data (MASS flag state traffic restrictions) 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG, …) egulations	ns der, specific positi ts, traffic informat	-	system
needed	 > Switch automatic Equipment > Navigational systems) > Information systems > Sensor data (MASS sensor data (MASS flag state traffic restrictions) 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,)	ns der, specific positi ts, traffic informat	-	system
needed	 > Switch automatic Equipment > Navigational systems) > Information systems > Sensor data (MASS sensor data (MASS flag state traffic restrictions) 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations	ns der, specific positi ts, traffic informat	-	system
needed Regulations Event: output	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS sensor data (MASS flag state traffic relations) MASS flag state traffic relations MASS is moored, port optimized 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations perations can start	ns der, specific positi ts, traffic informat	tion)	
needed Regulations Event: output Required	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic re Local port state and coas MASS is moored, port op The MASS Navigator (or state sector) 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations perations can start	ns der, specific positi ts, traffic informat	-	
needed Regulations Event: output Required competences	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic re Local port state and coas MASS is moored, port op The MASS Navigator (or regarding knowledge (C/ 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations perational level) is able (L 1) and understanding (C.	ns der, specific positi ts, traffic informat /L 2)	ion)	STCW
needed Regulations Event: output Required competences MASS	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic regulations MASS is moored, port op The MASS Navigator (or regarding knowledge (C/ to understand radar area 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations berations can start perational level) is able <i>I</i> 1) and understanding (<i>C</i> , and ARPA regarding perfor	ns der, specific positi ts, traffic informat /L 2)	tion)	STCW
needed Regulations Event: output Required competences MASS Navigator	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic relations MASS flag state traffic relations MASS is moored, port op The MASS Navigator (or regarding knowledge (C/ to understand radar a types, and limitations 	(ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations berations can start (perational level) is able (<i>L</i> 1) and understanding (<i>C</i> , and ARPA regarding perfor	ns der, specific positi ts, traffic informat /L 2) mance, use,	tion) C/L 2	STCW
needed Regulations Event: output Required competences MASS Navigator Operational	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic re Local port state and coas MASS is moored, port op The MASS Navigator (or regarding knowledge (C/ to understand radar at types, and limitations to understand ECDIS 	(ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations berations can start (perational level) is able (<i>L</i> 1) and understanding (<i>C</i>) and ARPA regarding perfor	ns der, specific positi ts, traffic informat /L 2) mance, use, I limitations	tion) C/L 2 2	STCW A-II/1 A-II/1
needed Regulations Event: output Required competences MASS Navigator Operational	 Switch automatic Equipment Navigational systems Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic regulations MASS flag state traffic regulations MASS is moored, port op The MASS Navigator (or regarding knowledge (C/ to understand radar a types, and limitations to understand ECDIS to explain the manoe 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations berations can start perational level) is able (<i>L</i> 1) and understanding (<i>C</i>) and ARPA regarding perfor 5 regarding capabilities and uvring and handling of a st	ns der, specific positi ts, traffic informat <i>/L 2)</i> mance, use, H limitations	tion) C/L 2 2 2 2 2 2	STCW A-II/1 A-II/1 A-II/1
needed Regulations Event: output Required competences MASS Navigator Operational	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic regulations The MASS Navigator (or regarding knowledge (C/ to understand radar a types, and limitations to explain the manoe to explain the navigation 	(ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations berations can start (perational level) is able (<i>L</i> 1) and understanding (<i>C</i>) and ARPA regarding perfor	ns der, specific positi ts, traffic informat <i>/L 2)</i> mance, use, H limitations	tion) C/L 2 2	STCW A-II/1 A-II/1 A-II/1
needed Regulations Event: output Required competences MASS Navigator Operational	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic related to the cost of the systems MASS is moored, port of the mass of the systems The MASS Navigator (or regarding knowledge (C/	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations berations can start (perational level) is able (<i>L</i> 1) and understanding (<i>C</i>) and ARPA regarding perfor 5 regarding capabilities and uvring and handling of a stational and communication s	ns der, specific positi ts, traffic informat /L 2) mance, use, I limitations hip system of a	tion) C/L 2 2 2 2 2 2 2	STCW A-II/1 A-II/1 A-II/1 MASS
needed Regulations Event: output Required competences MASS Navigator Operational	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic regulations MASS flag state traffic regulations MASS is moored, port op The MASS Navigator (oregarding knowledge (C/	on systems to port conditions (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations operational level) is able perational level) is able perational level) is able and ARPA regarding perfor and ARPA regarding perfor and ARPA regarding perfor and and communication states tional and communication states and of a MASS regarding the	ns der, specific positi ts, traffic informat <i>/L 2)</i> mance, use, I limitations hip system of a e mooring	tion) C/L 2 2 2 2 2 2	STCW A-II/1 A-II/1 A-II/1 MASS
needed Regulations Event: output Required competences MASS Navigator Operational	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic relations MASS flag state traffic relations MASS is moored, port op The MASS Navigator (or regarding knowledge (C/ to understand radar a types, and limitations to explain the manoe to explain the navigar MASS to explain the handlir equipment and the use 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations berations can start perational level) is able (<i>L</i> 1) and understanding (<i>C</i>) and ARPA regarding perfor and ARPA regarding perfor and and communication start tional and communication start	ns der, specific positi ts, traffic informat // 2) mance, use, d limitations hip system of a e mooring ies	tion) C/L 2 2 2 2 2 2 2	STCW A-II/1 A-II/1 A-II/1 MASS
needed Regulations Event: output Required competences MASS Navigator Operational	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic related to the cost of the mass of th	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations berations can start perational level) is able (<i>L</i> 1) and understanding (<i>C</i> , and ARPA regarding perfor 5 regarding capabilities and uvring and handling of a sh tional and communication sh og of a MASS regarding the se of automated port faciliti <i>lying (C/L 3) and analysing</i>	ns der, specific positi ts, traffic informat / <i>L 2)</i> mance, use, I limitations hip system of a e mooring ies (<i>C/L 4</i>)	tion) C/L 2 2 2 2 2 2 2	STCW A-II/1 A-II/1 A-II/1 MASS MASS
needed Regulations Event: output Required competences MASS Navigator	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic regulations MASS is moored, port op The MASS Navigator (or regarding knowledge (C/ to understand radar a types, and limitations to explain the manoe to explain the navigation MASS to explain the handlir equipment and the use regarding using and application to conduct a passage 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations berations can start perational level) is able (<i>L</i> 1) and understanding (<i>C</i>) and ARPA regarding perfor and ARPA regarding perfor and and communication start tional and communication start	ns der, specific positi ts, traffic informat / <i>L 2)</i> mance, use, I limitations hip system of a e mooring ies (<i>C/L 4</i>)	tion) C/L 2 2 2 2 2 2 2	STCW A-II/1 A-II/1 MASS MASS
needed Regulations Event: output Required competences MASS Navigator Operational	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic regulations MASS flag state traffic regulations MASS is moored, port op The MASS Navigator (oregarding knowledge (C/	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations berations can start perational level) is able (<i>L</i> 1) and understanding (<i>C</i>) and ARPA regarding perfor be regarding capabilities and uvring and handling of a sh tional and communication sh and of a MASS regarding the se of automated port facilities (<i>C/L</i> 3) and analysing and determine a position	ns der, specific positi ts, traffic informat / <i>L 2)</i> mance, use, t limitations hip system of a e mooring ies (<i>C/L 4</i>) by using	tion) C/L 2 2 2 2 2 3	STCW A-II/1 A-II/1 A-II/1 MASS MASS A-II/1
needed Regulations Event: output Required competences MASS Navigator Operational	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic relations MASS flag state traffic relations MASS flag state traffic relations The MASS Navigator (or regarding knowledge (C/ to understand radar a types, and limitations to understand ECDIS to explain the manoe to explain the navigation matches to explain the navigation of the manoe to explain the navigation of the manoe	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations berations can start perational level) is able (<i>L</i> 1) and understanding (<i>C</i> , and ARPA regarding perfor 5 regarding capabilities and uvring and handling of a sh tional and communication sh og of a MASS regarding the se of automated port faciliti <i>lying (C/L 3) and analysing</i>	ns der, specific positi ts, traffic informat / <i>L 2)</i> mance, use, t limitations hip system of a e mooring ies (<i>C/L 4</i>) by using	tion) C/L 2 2 2 2 2 2 2	STCW A-II/1 A-II/1 A-II/1 MASS
needed Regulations Event: output Required competences MASS Navigator Operational	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic rel Local port state and coas MASS is moored, port op The MASS Navigator (or regarding knowledge (C/ to understand radar a types, and limitations to explain the manoe to explain the navigation matches to explain the handlir equipment and the use regarding using and appeliation of the conduct a passage electronic systems to conduct a passage sounders 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations berations can start perational level) is able (<i>L</i> 1) and understanding (<i>C</i>) and ARPA regarding perfor 5 regarding capabilities and uvring and handling of a sh tional and communication sh and of a MASS regarding the se of automated port facilities (<i>C/L</i> 3) and analysing and determine a position and determine a position	ns der, specific positi ts, traffic informat / <i>L 2)</i> mance, use, I limitations hip system of a e mooring ies (<i>C/L 4)</i> by using by using echo-	tion) C/L 2 2 2 2 3 3 3	STCW A-II/1 A-II/1 A-II/1 MASS MASS A-II/1 A-II/1
needed Regulations Event: output Required competences MASS Navigator Operational	 Switch automatic Equipment Navigational systems Information systems Sensor data (MASS s International regulations MASS flag state traffic rel Local port state and coas MASS is moored, port op The MASS Navigator (or regarding knowledge (C/ to understand radar a types, and limitations to explain the manoe to explain the navigation matches to explain the handlir equipment and the use regarding using and appeliation of the conduct a passage electronic systems to conduct a passage sounders 	on systems to port conditio (ECDIS, radar, AIS, sound (publications, MIS, forecas status) (COLREG,) egulations stal state traffic regulations berations can start perational level) is able (<i>L</i> 1) and understanding (<i>C</i>) and ARPA regarding perfor be regarding capabilities and uvring and handling of a sh tional and communication sh and of a MASS regarding the se of automated port facilities (<i>C/L</i> 3) and analysing and determine a position	ns der, specific positi ts, traffic informat / <i>L 2)</i> mance, use, I limitations hip system of a e mooring ies (<i>C/L 4)</i> by using by using echo-	tion) C/L 2 2 2 2 2 3	STCW A-II/1 A-II/1 A-II/1 MASS MASS A-II/1

Process 3.5.2	Navigation when Entering the Port - Arrival / Berthing		
	to conduct a passage by using and adjusting steering control	3	A-II/1
	systems		
	to conduct a passage by using and interpreting meteorological	4	A-II/1
	information		
	to maintain a safe navigational watch by analysing traffic	4	A-II/1
	situations and applying the international Regulations for		
	Preventing Collisions at Sea		
	to maintain a safe navigational watch by using all equipment,	3	A-II/1
	provisions, information, regulations, principles, techniques, and		
	procedures for watchkeeping		
	As a sintain a sefere a sinchian al contale has a such in a builder.	3	A-II/1
	to maintain a safe navigational watch by applying bridge resource management principles		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
		4	A-II/1
	to use radar and ARPA to maintain safety of navigation		A-II/1 A-II/1
	to operate radar navigation by interpreting and analysing radar	4	A-11/ 1
	and ARPA information		A 11/4
	to operate ECDIS by interpreting and analysing of information	4	A-II/1
	obtained from ECDIS		
	to monitor and operate the data and information exchange	4	MASS
	between MASS and all relevant stations		
	to use specific navigational aids for MASS	3	MASS
	to use all navigational tools remotely to verify and assess the	4	MASS
	MASS position, course and speed		
	to interpret the environmental conditions remotely and to verify	4	MASS
	and assess the status of the MASS in the sea		
	to monitor and operate sensor systems by interpretation and	4	MASS
	analysing reliability of provided information		
	to monitor the automated functionalities of a MASS	4	MASS
	to analyse and adjust automated systems in terms of	4	MASS
	navigational parameters		
	to take over the control from automated systems	4	MASS
Boquirod	The MASS Senior Navigator (management level) is able	C/L	STCW
Required		C/L	31000
competences	regarding evaluating (C/L 5) and creating (C/L 6)	_	
MASS Senior	to determine positions and assess accuracy of resultant	5	A-II/2
Navigator	position fix by terrestrial observations		
Management	to determine positions and assess accuracy of resultant	5	A-II/2
Level	position fix by modern electronic navigational aids		
	to determine and allow for compass errors (magnetic and gyro)	5	A-II/2
	to establish watchkeeping arrangements and procedures	5	A-II/2
	to maintain safe navigation through the use of information from	5	A-II/2
	navigation equipment and systems to assist command		
	decision making		
	to maintain the safety of navigation through the use of ECDIS	5	A-II/2
	and associated navigation systems to assist command		
	decision making		
	to forecast weather and oceanographic conditions	5	A-II/2
	to manoeuvre and handle a ship in all conditions, especially	5	A-II/2
	when berthing or docking, and when using tugs		
		5	A-II/2
	to manoeuvre and handle a ship in all conditions, especially		7-11/2
	manoeuvring in restricted and shallow waters	5	MASS
	to take over command by changing from automated to manual	5	IVIA33
	mode of a MASS		



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Process 3.5.2	Navigation when Entering the Port - Arrival / Berthing		
	to communicate remotely with port services when berthing or	4	MASS
	unberthing		
	to handle a MASS safely in all manoeuvres such as berthing,	5	MASS
	anchoring, fairway, and sea passages		
	to handle a MASS according to environmental influences	5	MASS
	to berth and unberth a MASS based on sensor data	5	MASS
	to evaluate and ensure the data and information exchange	5	MASS
	between MASS and all relevant stations		
	to evaluate the reliability of data and information provided by	5	MASS
	sensor systems		
	to coordinate and adjust the different automated functionalities	5	MASS
	of a MASS		
	to analyse and adjust automated systems in terms of	5	MASS
	navigational parameters		
Additional	Л.		
comments			

3.6 Port stay

Process 3.6		Port Stay				
Scope of	All types of MASS					
application	 A) Dry Cargo – Container Feeder – short sea B) Ferry – RoPax – one hour passage 					
	C) Dry Cargo – Bulk Carrie	C) Dry Cargo – Bulk Carrier – long distances				
	MASS with crew on board					
	> Remote Control Centre					
	MASS without crew on board					
	> Remote Control Centre					
Process	To stay safely in the port with fo	ocus on the MASS sa	afety			
objectives						
Process	MASS operators in RCC	Level	in RCC	RACI		
operators	> Navigator	 Operational 	> Monitoring station	R, A		
Interfaces	> Port control					
	> Local port AFS and port faci	lities				
	> Terminal					
Event: input	Moored MASS, commence of p	ort operations				
Process	Maintaining a port watch with fo	cus to safe conditior	n of the MASS			
description	> Monitoring all MASS-sh	ore connections				
	> Monitoring environment	tal conditions to iden	tify hazardous situations	i		
	> Monitoring of availability	y of all MASS system	ns required in the port			
	 > Operating of remote-co 	ntrolled equipment				
Resources	Equipment					
needed	> MASS status information					
	> Sensor data (MASS status)					
Regulations	International regulations					
	MASS flag state traffic regulation	ons				
	Local port state and coastal sta	te traffic regulations				
Event: output	MASS in safe and operational c	onditions				

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Required	The MASS Navigator (operational level) is able	C/L	STCW
competences	regarding knowledge (C/L 1) and understanding (C/L 2)		
MASS	to explain the navigational and communication system of a MASS	2	MASS
Navigator Operational Level	to explain the handling of a MASS regarding the mooring equipment and the use of automated port facilities regarding using and applying (C/L 3) and analysing (C/L 4)	2	MASS
	to observe meteorological information	4	A-II/1
	to maintain a safe navigational watch by using all equipment, provisions, information, regulations, principles, techniques, and procedures for watchkeeping	3	A-II/1
	to monitor and operate all connections of the MASS with the shore	4	MASS
	to monitor and operate the data and information exchange between MASS and all relevant stations	4	MASS
	to monitor and operate sensor systems by interpretation and analysing reliability of provided information	4	MASS
	to monitor the automated functionalities of a MASS	4	MASS
	to analyse and adjust automated systems in terms of operational parameters	4	MASS
	to take over control from automated systems according to alarm levels	4	MASS
Additional comments	1.		

4 Engineering Operations

4.1 Utilisable Condition of MASS System

4.1.1 Bunker and Supply

Process 4.1.1	Utilisable Condition	of MASS System -	Bunker ar	nd Supply	
Scope of	All types of MASS				
application	A) Dry Cargo – Container	Feeder – short sea			
	 B) Ferry – RoPax – one hour passage 				
	C) Dry Cargo – Bulk Carrier – long distances				
	MASS with crew on board				
	> Remote Operation Cer	ntre			
	MASS without crew on board	i			
	> Remote Operation Cer	ntre			
Process	To provide the MASS with all fu	uel, power, provisions	, consuma	bles for the	
objectives	passage				
Process	MASS operators in ROC	Level	in ROC		RACI
operators	> Senior Engineer	> Management	> Plann	ing station	R, A
	> Engineer	> Operational	> Monit	oring station	R
	> System Administrator	> Operational	> Monite	oring station	С
Interfaces	> Terminal and port facilities	<u> </u>			
	> Service providers				
	> Shipping company - operat	ions			
Event: input	Status of products and materia	l on board, battery ch	arging stat	tus	
Process	 Connect all automated sup 	ply lines			
description	> Monitor supply operations				
	> Initiate securing of the area	and avoiding environ	mental im	pact	
	> Load spare parts	Ū			
Resources	Equipment				
needed	> Bunkering and charging sys	stems			
	> Ballast and tank system				
Regulations	International regulations				
-	MASS flag state traffic regulation	ons			
	Local port state regulations				
Event: output	MASS is able to sail the planne	ed voyage			
Required	The MASS Engineer (operation	onal level) is able		C/L	STCW
competences	regarding knowledge (C/L 1) a	nd understanding (C/I	L 2)		
MASS	to explain the provisions an	d requirements of no	n-fossil	2	MASS
Engineer	fuels				
Operational	regarding using and applying (C/L 3) and analysing	(C/L 4)		
Level	to ensure compliance with	pollution-prevention		3	A-III/1
	requirements				
	to maintain seaworthiness	· · ·	ship	3	A-III/1
	stability, trim, stress, and w				
	to maintain seaworthiness	•		3	A-III/1
	fundamental action in the e	vent of partial loss of	intact		
	stability				
	to operate and control auto		is with	3	MASS
	monitoring and control func	tions			

	1		
	to operate and monitor automated battery charging	3	MASS
	system with monitoring and control functions		
Required	The MASS Senior Engineer (management level) is able	C/L	STCW
competences	regarding evaluating (C/L 5) and creating (C/L 6)		
MASS Senior	to plan and schedule operations by consideration of	5	A-III/2
Engineer	physical and chemical properties of fuels and lubricants	-	
Management	to manage fuel, lubrication, and ballast operations	5	A-III/2
Level	including the operation of machinery such as pumps and		
	piping systems		
	to manage automated and remote-controlled bunkering	5	MASS
	systems		MAGO
		5	MASS
		5	IVIA55
	charging systems		
Required	The MASS System Administrator (operational level) is	C/L	STCW
competences	able		
MASS	regarding using and applying (C/L 3) and analysing (C/L 4)		
System	to ensure compliance with pollution-prevention	3	A-III/6
Administrator	requirements		
Operational	to operate and monitor automated battery charging	3	MASS
Level	systems		
Additional			
comments			
comments			

4.1.2 System Checks

Process 4.1.2	Utilisable Conditi	on of MASS system	n - Systems Checks	
Scope of application	All types of MASS A) Dry Cargo – Containe B) Ferry – RoPax – one C) Dry Cargo – Bulk Care MASS with crew on board Remote Operation Ce MASS without crew on boar Remote Operation Ce	hour passage rier – long distances entre d		
Process objectives	To ensure that the MASS is function necessary to sail a safe voyage	•	ilable with all functionalit	ies
Process operators	 MASS operators in ROC Senior Engineer Engineer System Administrator 	Level Management Operational Operational 	 in ROC Monitoring station Monitoring station Monitoring station 	RACI R, A R C
Interfaces Event: input	 All MASS and ROC system Voyage order with operational 	ns		
Process description	 Check and prepare of propulsion systems (according to type of ship and propulsion system) Check and prepare all auxiliary systems (according to ship type) Check and prepare automation and communication systems Operate plausibility checks for system integrity and reliability Confirm "ready to go" status 			
Resources needed	Equipment All MASS systems 			



Process 4.1.2	Utilisable Condition of MASS system - Systems Che	cks	
Regulations	International regulations		
	MASS flag state traffic regulations		
	Local port state regulations		
Event: output	MASS with all systems is "ready to go"		
Required	The MASS Senior Navigator (management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS	to operate remote controls of propulsion plant and engineering	4	A-II/2
Navigator	systems and services		
Management			
Level			
Required	The MASS Engineer (operational level) is able	C/L	STCW
competences	regarding knowledge (C/L 1) and understanding (C/L 2)	_	
MASS	to explain the ship construction	2	A-III/1
Engineer	to explain the entire automation system with interfaces and	2	MASS
Operational	control parameters	_	
Level	to explain the digital twin of the MASS	2	MASS
	regarding using and applying (C/L 3) and analysing (C/L 4)	3	MAGG
	to operate system checks of automated systems by using	3	MASS
Required	operational scenarios The MASS Senior Engineer (management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)	U/L	31000
MASS Senior	to apply the IMO regulations about control trim, stability, and	3	A-III/2
Engineer	stress	5	A-111/2
Management	regarding evaluating (C/L 5) and creating (C/L 6)		
Level	to plan and schedule operations by consideration of	5	A-III/2
	technology of materials and ship construction		/
	to operate, observe, assess performance and maintain safety	5	A-III/2
	of propulsion plant and auxiliary machinery		
	to manage operation of electrical and electronic control	5	A-III/2
	equipment		
	to control trim, stability, and stress and take measures to	5	A-III/2
	preserve trim and stability		
	to evaluate system checks based on operational scenarios and	5	MASS
	to manage corrective measures		
	to evaluate systems integrity and reliability by applying	5	MASS
	plausibility checks and using digital twins		
	to evaluate the reliability of data and information provided by	5	MASS
	sensor systems		
	to coordinate and adjust the different automated functionalities	5	MASS
	of a MASS		
Required	The MASS System Administrator (operational level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		GIGW
MASS	to monitor the operation of electrical, electronic, and control	4	A-III/6
System	systems		
Administrator	to monitor the operation of automatic control systems of	4	A-III/6
Operational	propulsion and auxiliary machinery		
Level	to operate generators and distribution systems	3	A-III/6
	to operate and maintain power systems in excess of 1,000	4	A-III/6
	volts		

Process 4.1.2	Utilisable Condition of MASS system - Systems Checks						
	to use internal communication systems						
	to operate system checks of automated systems by using operational scenarios	3	MASS				
Additional							
comments							

4.2 Control of MASS Performance

4.2.1 Auxiliary and Machinery Systems

Process 4.2.1	Control of MASS Performance - Auxiliary and Mac	hinery System	IS		
Scope of	All types of MASS				
application	A) Dry Cargo – Container Feeder – short sea				
	B) Ferry – RoPax – one hour passage				
	C) Dry Cargo – Bulk Carrier – long distances				
	MASS with crew on board				
	> Remote Operation Centre				
	MASS without crew on board				
	> Remote Operation Centre				
Process	To keep all auxiliary and machinery systems available and o	operate them o	า		
objectives	required performance levels				
Process	MASS operators in ROC Level in ROC)	RACI		
operators	> Senior Engineer > Management > Mo	nitoring station	R, A		
	> Engineer > Operational > Mo	nitoring station	R		
	> System Administrator > Operational > Mo	nitoring station	С		
Interfaces	> All MASS auxiliary and machinery systems				
Event: input	MASS is in operations				
Process	 Control of automated auxiliary and machinery systems, 	n engine, deck	and		
description	accommodation departments				
	> Control of automated power management and availabilit	y of systems			
Resources	Equipment				
needed	> All auxiliary and machinery systems				
Regulations	International regulations				
	MASS flag state traffic regulations				
	Local port state regulations				
Event: output	All auxiliary and machinery systems are operating as require	ed			
Required	The MASS Engineer (operational level) is able	C/L	STCW		
competences	regarding knowledge (C/L 1) and understanding (C/L 2)				
MASS	to explain the fundamentals of process data processing	2	MASS		
Engineer	to explain fundamentals of mathematics and statistics in	terms 2	MASS		
Operational	of operation engineering				
Level	to explain the sensor technologies used in automated sy	vstems 2	MASS		
	to explain robotic technologies and how to use them in MASS 2 MASS operation engineering				
	to discuss MASS-specific propulsion and auxiliary systems 2 MAS and their use for autonomous ships				
	to explain the limitations of automation, e.g., in challengi environmental conditions	ng 2	MASS		

Process 4.2.1							
	regarding using and applying (C/L 3) and analysing (C/L 4)						
	to maintain a safe engineering watch, keeping the watch with	3	A-III/1				
	all duties	2					
	to use internal communication systems	3 3	A-III/1 A-III/1				
	to operate main and auxiliary machinery and associated control systems	3	A-111/ 1				
	to operate fuel, lubrication, ballast, and other pumping systems	3	A-III/1				
	and associated control systems						
	to operate electrical, electronic, and control systems	3	A-III/1				
	to monitor cellular and satellite communication networks	4	MASS				
	to take over manual control from automated systems in all situations	4	MASS				
	to monitor and operate the data and information exchange	4	MASS				
	between MASS and all relevant stations						
	to monitor and operate sensor systems by interpreting and	4	MASS				
	analysing reliability of provided information						
	to monitor the automated functionalities of a MASS	4	MASS				
	to analyse and adjust automated systems in terms of	4	MASS				
	engineering parameters						
Required	The MASS Senior Engineer (management level) is able	C/L	STCW				
competences	regarding using and applying (C/L 3) and analysing (C/L 4)						
MASS Senior Engineer	to analyse the automatic control systems by diagnostic applications	4	MASS				
Management	to analyse automatic control systems by using digital twins	4	MASS				
Level	to use robotic systems for inspections on MASS	3	MASS				
	regarding evaluating (C/L 5) and creating (C/L 6)		11/1/100				
	to plan and schedule operations by consideration of physical	5	A-III/2				
	fundamentals	_					
	to plan and schedule operations for refrigeration systems	5	A-III/2				
	to perform operations, surveillance, performance assessment, and maintain safety of auxiliary machinery	5	A-III/2				
	to more an evolution of all string and all stranging control	5	A-III/2				
	equipment	0	/Ζ				
	to manage troubleshooting, and restoration of electrical and	5	A-III/2				
	electronic control equipment to operating condition						
	to evaluate the performance of auxiliary and machinery	5	MASS				
L	automatic controlled systems						
Required competences	The MASS System Administrator (operational level) is able regarding knowledge (C/L 1) and understanding (C/L 2)	C/L	STCW				
MASS	to explain the fundamentals of process data processing	2	MASS				
System	to explain fundamentals of mathematics and statistics in terms	2	MASS				
Administrator	of operation engineering						
Operational	to explain the sensor technologies used in automated systems	2	MASS				
Level	regarding using and applying (C/L 3) and analysing (C/L 4)						
	to monitor the operation of electrical, electronic and control systems	4	A-III/6				
	to monitor the operation of automatic control systems of	4	A-III/6				
	propulsion and auxiliary machinery		A 111/0				
	to operate generators and distribution systems	3	A-III/6				
	to operate and maintain power systems in excess of 1,000 volts	4	A-III/6				
	to operate computers and computer networks on ships	3	A-III/6				
	· · · · · · · · · · · · · · · · · · ·						

Process 4.2.1	Control of MASS Performance - Auxiliary and Machinery Systems						
	to use internal communication systems	3	A-III/6				
	to monitor cellular and satellite communication networks	4	MASS				
Additional	Л.						
comments							

4.2.2 Propulsion Systems

uired station station station	RACI R, A
station	R, A
station	
station	R
	С
c motor	's and
nuth dri	ves)
C/L	STCW
2	MASS
2	MASS
r	C/L 2 2 2 2 2 2



Process 4.2.2	Control of MASS Performance - Propulsion S	ystems	
	regarding using and applying (C/L 3) and analysing (C/L 4)		
	to maintain a safe engineering watch, keeping the watch	3	A-III/1
	with all duties		
	to use internal communication systems	3	A-III/1
	to operate main and auxiliary machinery and associated	3	A-III/1
	control systems		
	to operate fuel, lubrication, ballast, and other pumping	3	A-III/1
	systems and associated control systems		
	to operate electrical, electronic, and control systems	3	A-III/1
	to operate wind propulsion systems (as Flettner rotors,	3	MASS
	rigid sails)		
	to operate fuel cells	3	MASS
	to operate power generation by solar cells and wind	3	MASS
	turbines		
	to monitor collular and actallity communication motivation	4	MASS
	to take over manual control from automated systems in	4	MASS
	all situations		11/1/100
Required	The MASS Senior Engineer (management level) is able	C/L	STCW
competences			
MASS Senior	regarding using and applying (C/L 3) and analysing (C/L 4)		
Engineer	to operate remote controls of propulsion plant	4	A-II/2
Management	to analyse the automatic control systems by diagnostic	4	MASS
Level	applications		
	to analyse automatic control systems by using digital	4	MASS
	twins		
	to use robotic systems for inspections on MASS	3	MASS
	regarding evaluating (C/L 5) and creating (C/L 6)		
	to plan and schedule operations by consideration of	5	A-III/2
	physical fundamentals	Ŭ	/
	to plan and schedule operations for refrigeration	5	A-III/2
	systems	Ŭ	/
	to perform operations, surveillance, performance	5	A-III/2
	assessment, and maintain safety of auxiliary machinery		/ <u>/</u> -111/2
	to monopole operation of clostrical and clostropic control	5	A-III/2
	equipment	5	7-111/2
	to memory travelaction and vectoration of all string	5	A-III/2
	and electronic control equipment to operating condition	5	A-111/2
		5	MASS
	to evaluate the performance of propulsion automatic controlled systems	5	IVIA33
		5	MAGG
		5	MASS
De su dine d	wind systems, fuel cells, electric systems	0"	
Required	The MASS System Administrator (operational level) is	C/L	STCW
competences	able		
MASS	regarding knowledge (C/L 1) and understanding (C/L 2)	2	MAGO
System	to explain the fundamentals of process data processing	2	MASS
Administrator	to explain fundamentals of mathematics and statistics in	2	MASS
Operational	terms of operation engineering	_	
Level	to explain the sensor technologies used in automated	2	MASS
	systems		
	regarding using and applying (C/L 3) and analysing (C/L 4)		
	to monitor the operation of electrical, electronic, and	4	A-III/6
	control systems		

Process 4.2.2	Control of MASS Performance - Propulsion Systems						
	to monitor the operation of automatic control systems of	4	A-III/6				
	propulsion and auxiliary machinery						
	to operate generators and distribution systems	3	A-III/6				
	to operate and maintain power systems in excess of	4	A-III/6				
	1,000 volts						
	to operate computers and computer networks on ships	3	A-III/6				
	to use internal communication systems	3	A-III/6				
	to monitor cellular and satellite communication networks	4	MASS				
Additional	./.						
comments							

4.2.3 Performance Monitoring

Process 4.2.3	Control of MASS P	erformance - Perfo	rmance Monitoring			
Scope of	All types of MASS					
application						
	B) Ferry – RoPax – one h	our passage				
	C) Dry Cargo – Bulk Carri	er – long distances				
	MASS with crew on board	0				
	> Remote Operation Cer	itre				
	MASS without crew on board					
	> Remote Operation Cer	itre				
Process	To control the MASS to stay wi		formance parameters			
objectives			•			
Process	MASS operators in ROC	Level	in ROC	RACI		
operators	> Senior Engineer	> Management	> Monitoring station	R, A		
·	> Engineer	> Operational	> Monitoring station	R		
	> System Administrator	> Operational	> Monitoring station	С		
Interfaces	> All MASS systems	•				
	> Shipping company - operati	ons				
Event: input	MASS is in operations					
·						
Process	> Monitoring the technical MA	SS systems				
description	Monitoring of propulsion system					
	Monitoring of auxiliary and machinery systems					
	Monitoring of hotelling	systems				
	Identification of deviation	ons				
	Change of settings when appropriate					
	Managing of alarms					
	Taking actions to stabilise the MASS systems if required					
	Calling experts when malfunctions occur					
	Pass the MASS to direct control stations in cases of failure search and					
	direct control activities					
Resources	Equipment					
needed	> All technical automatic cont	rolled systems				
	> Sensor data (MASS status)					
Regulations	International regulations					
	MASS flag state traffic regulations					
	Local port state regulations					



Process 4.2.3	Control of MASS Performance - Performance Monit	oring	
Event: output	The MASS is operating within the planned performance parameter	S	
Required	The MASS Engineer (operational level) is able	C/L	STCW
competences	regarding knowledge (C/L 1) and understanding (C/L 2)		
MASS	to explain hydrodynamic parameters, provisions of coatings,	2	MASS
Engineer	and air lubrication systems influencing hull performance		
Operational Level	to explain physical parameters influencing MASS performance	2	MASS
	to describe the system of sensors and how to use them to keep situational awareness	2	MASS
	regarding using and applying (C/L 3) and analysing (C/L 4)		
	to maintain a safe engineering watch, keeping the watch with all duties	3	A-III/1
	to use internal communication systems	3	A-III/1
	to operate main and auxiliary machinery and associated control systems	3	A-III/1
	to operate fuel, lubrication, ballast, and other pumping systems and associated control systems	3	A-III/1
	to operate electrical, electronic, and control systems	3	A-III/1
	to operate the remote-control systems with its specific interfaces	3	MASS
	to monitor cellular and satellite communication networks	4	MASS
Required	The MASS Senior Engineer (management level) is able	C/L	STCW
competences MASS Senior	regarding evaluating (C/L 5) and creating (C/L 6) to plan and schedule operations by consideration of physical fundamentals	5	A-III/2
Engineer Management Level	to plan and schedule operations for propulsion and auxiliary systems	5	A-III/2
20101	to perform operations, surveillance, performance	5	A-III/2
	assessment, and maintaining safety of propulsion plant and auxiliary machinery		/
	to manage operation of electrical and electronic control equipment	5	A-III/2
	to evaluate the remote-control system for integrity and reliability	5	MASS
Required	The MASS System Administrator (operational level) is able	C/L	STCW
competences			
MASS	regarding using and applying (C/L 3) and analysing (C/L 4)		
System	to analyse the performance of automation control and data	4	MASS
Administrator	processing systems		
Operational Level	to monitor cellular and satellite communication networks	4	MASS
Additional	J.		
comments			

4.2.4 Hotelling

Process 4.2.4	Control of	MAS	SS Performance) - H	otelling			
Scope of	All types of MASS							
application	 A) Dry Cargo – Container Feeder – short sea 							
	B) Ferry – RoPax – one hour passage							
	C) Dry Cargo – Bulk Carrier – long distances							
	MASS with crew on board							
	> Remote Operation Centre							
	MASS without crew on board							
	> Remote Operation Cer	ntre						
Process	To keep all hotelling systems a		able and operate	the	m on requir	red perfor	mance	
objectives	levels		•		•			
Process	MASS operators in ROC	Le	vel	in	ROC		RACI	
operators	 Senior Engineer 	>	Management	>	Monitorin	a station	R, A	
	> Engineer	>	Operational	>	Monitorin	-	R	
	 System Administrator 	>	Operational	>	Monitorin	-	C	
Interfaces	 All MASS hotelling systems 		Operational	-	Monitoring	g station	U	
Internaces)						
Event: input	MASS is in operations, persons	- on	board					
Event. Input		5 011	DUAIU					
Process	Control of outomated batall	ina						
	> Control of automated hotell	ing :	systems					
description	Fauria na ent							
Resources	Equipment		freeh weter own	ي ا م			hi a la	
needed	> All propulsion systems (suc			ріу	and sewage	e, ventila	tion	
Degulations	and air condition, convenie	ence	systems)					
Regulations	International regulations							
	MASS flag state traffic regulation	ons						
F	Local port state regulations	4						
Event: output	All hotelling systems are opera	ung	as required					
Required	The MASS Engineer (operation	nal	loval) is able			C/L	STCW	
competences	regarding knowledge (C/L 1) al		•			0/2	31000	
MASS	to explain the fundamentals					2	MASS	
			• •		•	2	MASS	
Engineer	to explain fundamentals of		nematics and sta	usu	csin	2	IVIA33	
Operational	terms of operation engineer	-			I			
Level	to explain the sensor techn	olog	lies used in autor	nate	ea	2	MASS	
	systems							
	to explain robotic technolog		and now to use t	nem	n In	2	MASS	
	MASS operation engineerin	-						
	regarding using and applying (,	•	•		A 111/4	
	to maintain a safe engineer	ing	watch, keeping ti	ne w	atch with	3	A-III/1	
	all duties						A 111/4	
	to use internal communicat		•			3	A-III/1	
	to operate main and auxilia	ry m	nachinery and as	soci	ated	3	A-III/1	
	control systems						A 111/4	
	to operate fuel, lubrication,			mpir	ng	3	A-III/1	
	systems, and associated co		-					
	to operate electrical, electro	onic,	, and control syst	ems	6	3	A-III/1	

Process 4.2.4	Control of MASS Performance - Hotelling		
Required	The MASS Senior Engineer (management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS Senior	to analyse the automatic control systems by diagnostic	4	MASS
Engineer	applications		
Management	to analyse automatic control systems by using digital twins	4	MASS
Level	to use robotic systems for inspections on MASS	3	MASS
	regarding evaluating (C/L 5) and creating (C/L 6) to plan and schedule operations by consideration of physical	5	A-III/2
	fundamentals	_	
	to plan and schedule operations for refrigeration systems	5	A-III/2
	to perform operations, surveillance, performance	5	A-III/2
	assessment, and maintain safety of auxiliary machinery		
	to manage operation of electrical and electronic control equipment	5	A-III/2
	to manage troubleshooting, and restoration of electrical and	5	A-III/2
	electronic control equipment to operating condition		
	to evaluate the performance of automatic controlled auxiliary	5	MASS
	systems		
Required	The MASS System Administrator (operational level) is able	C/L	STCW
competences			
MASS	regarding knowledge (C/L 1) and understanding (C/L 2)		
System	to explain the fundamentals of process data processing	2	MASS
Administrator	to explain fundamentals of mathematics and statistics in	2	MASS
Operational	terms of operation engineering		
Level	to explain the sensor technologies used in automated systems	2	MASS
	regarding using and applying (C/L 3) and analysing (C/L 4)		
	to monitor the operation of electrical, electronic, and control systems	4	A-III/6
	to monitor the operation of automatic control systems of	4	A-III/6
	propulsion and auxiliary machinery		
	to operate generators and distribution systems	3	A-III/6
	to operate and maintain power systems in excess of 1,000 volts	4	A-III/6
	to operate computers and computer networks on china	3	A-III/6
	to use internal communication systems	3	A-III/6
Additional		0	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
comments	- <i>i</i> .		
commenta			

4.3 Discharging residues

Process 4.3	Discharging residues
Scope of	All types of MASS
application	A) Dry Cargo – Container Feeder – short sea
	B) Ferry – RoPax – one hour passage
	C) Dry Cargo – Bulk Carrier – long distances
	MASS with crew on board
	> Remote Operation Centre
	MASS without crew on board
	> Remote Operation Centre

Process 4.3	Discharging residues				
Process	To discharge all residues by av	oiding any environm	ental impact		
objectives					
Process	MASS operators in ROC	Level	in ROC		RACI
operators	> Senior Engineer	> Management	> Monitoring	station	R, A
	> Engineer	> Operational	> Monitoring	station	R
	> System Administrator	 Operational 	> Monitoring	station	С
Interfaces	> Terminal				
	> Port AFS				
Event: input	MASS is alongside and ready f	or port operations			
Process	 Discharge of garbage and s 	ewage			
description	> Discharge of residues of no		d harmful substai	nces	
	> Discharge of oily residues,				
Resources	Equipment				
needed	> Discharging system with se	nsors			
Regulations	International regulations				
5	MASS flag state traffic regulations				
	Local port state regulations				
Event: output	All residues discharged without	environmental impa	ict		
Required	The MASS Navigator (operati	onal level) is able		C/L	STCW
competences	regarding knowledge (C/L 1) ar	nd understanding (C	/L 2)		
MASS	to explain automatic port fac	cilities		2	MASS
Navigator	regarding using and applying (0	C/L 3) and analysing	(C/L 4)		
Operational	to keep the MASS in position	n for discharging op	erations	3	MASS
Level					
Required	The MASS Engineer (operation	•		C/L	STCW
competences	regarding knowledge (C/L 1) ar		/L 2)		
MASS	to explain automatic port fac			2	MASS
Engineer	regarding using and applying (0				
Operational	to operate fuel, lubrication,		mping systems,	3	A-III/1
Level	and associated control syst				
	to ensure compliance with p	•	•	3	A-III/1
	to operate automatic port fa		•	3	MASS
Required	The MASS Senior Engineer (r	• ,	is able …	C/L	STCW
competences	regarding evaluating (C/L 5) an	- , ,			
MASS Senior	to consider all regulations for	-	charge by	5	MASS
Engineer	using automated port facilit	es			
Management					
Level					
Additional	./.				
comments					



5 Maintenance

5.1 Maintenance in Port

5.1.1 Maintenance Planning

Process 5.1.1	Maintenance	in Port – Maintena	ance Planning			
Scope of	All types of MASS					
application	A) Dry Cargo – Container					
	B) Ferry – RoPax – one h					
	C) Dry Cargo – Bulk Carri	er – long distances				
	MASS with crew on board					
		······· • • • • • • • • • • • • • • • •				
	MASS without crew on board					
	> Remote Operation Cen					
Process	To plan the preventive and cura		of all MASS (bridg	je, decl	Κ,	
objectives	engine) and ROC (workstations				DAOL	
Process	MASS operators in ROC	Level	in ROC		RACI	
operators	> Senior Navigator	> Management	 Planning sta 		R, A	
	> Senior Engineer	> Management	 Planning sta 		R	
	> System Administrator	> Operational	 Planning sta 	ition	R	
Interfaces	> Shipping company - operati	ons				
	> Service provider					
E	> Manufacturer	1. f		-		
Event: input	Periodical revision of systems s	status and maintena	ance requirement	s		
Process	> Inspections of all systems					
description	> Condition monitoring of all s	systems				
	> Inspection of MASS structure	res				
	> Planning of preventive main	tenance (time-base	ed, condition-base	ed)		
	> Planning curative maintenal	nce (repairs, overha	auls)			
	> Planning of class works and	l inspections	-			
Resources	Equipment					
needed	> All systems and equipment	on board				
	> All systems and equipment	in ROC				
Regulations	International regulations					
	MASS flag state and class regu					
	Local port state and coastal sta		6			
Event: output	Maintenance tasks and job orde	ers are planned				
Required	The MASS Senior Navigator (management leve	I) is able	C/L	STCW	
competences	regarding using and applying (0	-	•			
MASS Senior	to apply maintenance strate	, , ,		3	MASS	
Navigator	based, or risk-based mainte	•				
Management	regarding evaluating (C/L 5) an					
Level	to perform remote analysis	- , ,	ers and	4	MASS	
	communication protocols to	•				
	to derive maintenance requ	•		5	MASS	
	to plan the tasks and jobs fo		-			
	to determine maintenance e		te use and	4	MASS	
	control					
	to derive maintenance requ	irements from opera	ating data	5	MASS	
	("predictive maintenance")		-			

/

Process 5.1.1	Maintenance in Port – Maintenance Planning		
Required	The MASS Senior Engineer (management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS Senior	to ensure safe working practices	3	A-III/2
Engineer	to manage safe and effective maintenance and repair	3	A-III/2
Management	procedures by application of knowledge of marine engineering		
Level	practice		
	to apply maintenance strategies as predictive, condition-	3	MASS
	based, or risk-based maintenance for a MASS		
	regarding evaluating (C/L 5) and creating (C/L 6)		
	to manage safe and effective maintenance and repair	5	A-III/2
	procedures		
	to detect and identify the cause of machinery malfunctions and	5	A-III/2
	correct faults		
	to perform remote analysis of system parameters and	4	MASS
	communication protocols to identify the root cause of failures		
	to derive maintenance requirements from operating data and	5	MASS
	to plan the tasks and jobs for a MASS		
	to determine maintenance equipment for remote use and	4	MASS
	control		
	to derive maintenance requirements from operating data	5	MASS
	("predictive maintenance")		
Required	The MASS System Administrator (operational level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
competences MASS	regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic	C/L 3	STCW A-III/6
competences MASS System	regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment	3	A-III/6
competences MASS System Administrator	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control 		
competences MASS System Administrator Operational	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery 	3 3	A-III/6 A-III/6
competences MASS System Administrator	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation 	3	A-III/6
competences MASS System Administrator Operational	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation equipment and ship communication systems 	3 3 3	A-III/6 A-III/6 A-III/6
competences MASS System Administrator Operational	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation equipment and ship communication systems to apply maintenance and repair of electrical, electronic, and 	3 3	A-III/6 A-III/6
competences MASS System Administrator Operational	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation equipment and ship communication systems to apply maintenance and repair of electrical, electronic, and control systems of deck machinery and cargo-handling 	3 3 3	A-III/6 A-III/6 A-III/6
competences MASS System Administrator Operational	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation equipment and ship communication systems to apply maintenance and repair of electrical, electronic, and control systems of deck machinery and cargo-handling equipment 	3 3 3 3	A-III/6 A-III/6 A-III/6 A-III/6
competences MASS System Administrator Operational	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation equipment and ship communication systems to apply maintenance and repair of electrical, electronic, and control systems of deck machinery and cargo-handling equipment to apply maintenance and repair of control and safety systems 	3 3 3	A-III/6 A-III/6 A-III/6
competences MASS System Administrator Operational	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation equipment and ship communication systems to apply maintenance and repair of electrical, electronic, and control systems of deck machinery and cargo-handling equipment to apply maintenance and repair of control and safety systems of hotel equipment 	3 3 3 3 3	A-III/6 A-III/6 A-III/6 A-III/6
competences MASS System Administrator Operational	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation equipment and ship communication systems to apply maintenance and repair of electrical, electronic, and control systems of deck machinery and cargo-handling equipment to apply maintenance and repair of control and safety systems of hotel equipment to use risk-based and predictive maintenance tools for 	3 3 3 3	A-III/6 A-III/6 A-III/6 A-III/6
competences MASS System Administrator Operational	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation equipment and ship communication systems to apply maintenance and repair of electrical, electronic, and control systems of deck machinery and cargo-handling equipment to apply maintenance and repair of control and safety systems of hotel equipment to use risk-based and predictive maintenance tools for inspection and maintenance 	3 3 3 3 3 3 3	A-III/6 A-III/6 A-III/6 A-III/6 MASS
competences MASS System Administrator Operational	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation equipment and ship communication systems to apply maintenance and repair of electrical, electronic, and control systems of deck machinery and cargo-handling equipment to apply maintenance and repair of control and safety systems of hotel equipment to use risk-based and predictive maintenance tools for inspection and maintenance to perform remote analysis of system parameters and 	3 3 3 3 3	A-III/6 A-III/6 A-III/6 A-III/6
competences MASS System Administrator Operational	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation equipment and ship communication systems to apply maintenance and repair of electrical, electronic, and control systems of deck machinery and cargo-handling equipment to apply maintenance and repair of control and safety systems of hotel equipment to use risk-based and predictive maintenance tools for inspection and maintenance to perform remote analysis of system parameters and communication protocols to identify the root cause of failures 	3 3 3 3 3 3 3	A-III/6 A-III/6 A-III/6 A-III/6 MASS
competences MASS System Administrator Operational	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation equipment and ship communication systems to apply maintenance and repair of electrical, electronic, and control systems of deck machinery and cargo-handling equipment to apply maintenance and repair of control and safety systems of hotel equipment to use risk-based and predictive maintenance tools for inspection and maintenance to perform remote analysis of system parameters and communication protocols to identify the root cause of failures <i>regarding evaluating (C/L 5) and creating (C/L 6)</i> 	3 3 3 3 3 3 4	A-III/6 A-III/6 A-III/6 A-III/6 MASS MASS
competences MASS System Administrator Operational	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation equipment and ship communication systems to apply maintenance and repair of electrical, electronic, and control systems of deck machinery and cargo-handling equipment to apply maintenance and repair of control and safety systems of hotel equipment to use risk-based and predictive maintenance tools for inspection and maintenance to perform remote analysis of system parameters and communication protocols to identify the root cause of failures regarding evaluating (C/L 5) and creating (C/L 6) to derive maintenance requirements from operational data and 	3 3 3 3 3 3 3	A-III/6 A-III/6 A-III/6 A-III/6 MASS
competences MASS System Administrator Operational Level	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation equipment and ship communication systems to apply maintenance and repair of electrical, electronic, and control systems of deck machinery and cargo-handling equipment to apply maintenance and repair of control and safety systems of hotel equipment to use risk-based and predictive maintenance tools for inspection and maintenance to perform remote analysis of system parameters and communication protocols to identify the root cause of failures regarding evaluating (C/L 5) and creating (C/L 6) to derive maintenance requirements from operational data and to plan the tasks and jobs for a MASS 	3 3 3 3 3 3 4	A-III/6 A-III/6 A-III/6 A-III/6 MASS MASS
competences MASS System Administrator Operational	 regarding using and applying (C/L 3) and analysing (C/L 4) to apply maintenance and repair of electrical and electronic equipment to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery to apply maintenance and repair of bridge navigation equipment and ship communication systems to apply maintenance and repair of electrical, electronic, and control systems of deck machinery and cargo-handling equipment to apply maintenance and repair of control and safety systems of hotel equipment to use risk-based and predictive maintenance tools for inspection and maintenance to perform remote analysis of system parameters and communication protocols to identify the root cause of failures regarding evaluating (C/L 5) and creating (C/L 6) to derive maintenance requirements from operational data and 	3 3 3 3 3 3 4	A-III/6 A-III/6 A-III/6 A-III/6 MASS MASS



5.1.2 Overhaul and Repair

Process 5.1.2	Maintenanc	e in Port – Overha	ul and Repair			
Scope of	All types of MASS					
application	A) Dry Cargo – Container	 A) Dry Cargo – Container Feeder – short sea 				
	B) Ferry – RoPax – one h	our passage				
	C) Dry Cargo – Bulk Carri	er – long distances				
	MASS with crew on board	ASS with crew on board				
	> Remote Operation Cer	ntre				
	MASS without crew on board	l				
	> Remote Operation Cer	ntre				
Process	To operate all corrective mainte	enance tasks				
objectives						
Process	MASS operators in ROC	Level	in ROC		RACI	
operators	> Navigator	> Operational	> Monitoring st	ation	R	
	> Engineer	> Operational	> Monitoring st	ation	R	
	> System Administrator	> Operational	> Monitoring st		R	
Interfaces	> Shipping company - operation	•			1	
	> Service provider					
	> Manufacturer					
Event: input	Planned and unplanned correc	tive repairs and ove	erhauls			
Process	 Control of corrective repairs 	· ·				
description	 Control of planned overhau 					
	> Control of all jobs on the M		station			
	 Update of systems and soft 					
Resources	Equipment					
needed	 All systems and equipment 	on board				
needed	 All systems and equipment 					
Regulations	International regulations					
rtogulationio	MASS flag state and class regu	ilations				
	Local port state and coastal sta		s			
Event: output	All MASS systems are in working	V	<u> </u>			
Liona output		ng ordor again				
Required	The MASS Navigator (operati	onal level) is able		C/L	STCW	
competences	regarding using and applying (•			••••	
MASS	to operate remote system u			4	MASS	
Navigator	communication systems	puatee of havigade				
Operational	to apply remotely all setting	s of the navigation:	al and	3	MASS	
Level	communication equipment	e er ute tildtigenet.				
	to analyse malfunction alar	ms and to identify n	eed for	4	MASS	
	corrections					
	to operate maintenance and	d repairs of MASS :	svstems	3	MASS	
Required	The MASS Engineer (operation		-	C/L	STCW	
competences	regarding using and applying (•		0/2	0.011	
MASS	to operate maintenance and			3	A-III/1	
Engineer	equipment					
Operational	to operate an appropriate u	se of hand tools m	achine tools	3	A-III/1	
Level	and measuring instruments					
_0.0.	to operate maintenance and		•	3	A-III/1	
	and equipment		_ maaninory			
	to operate maintenance an	d repairs of MASS	systems	3	MASS	
	to integrate machinery and		-	3	MASS	
	remote-control system agai					
	ioniolo-ooniioi system agai	in and to operate te				

Process 5.1.2	Maintenance in Port – Overhaul and Repair		
	to perform remote analysis of system parameters and communication protocols to identify the root cause of failures	4	MASS
	to use risk-based and predictive maintenance tools for inspection and maintenance	4	MASS
Required competences	The MASS System Administrator (operational level) is able regarding using and applying (C/L 3) and analysing (C/L 4)	C/L	STCW
MASS System	to apply maintenance and repair of electrical and electronic equipment	3	A-III/6
Administrator Operational	to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery	3	A-III/6
Level	to apply maintenance and repair of bridge navigation equipment and ship communication systems	3	A-III/6
	to apply maintenance and repair of electrical, electronic, and control systems of deck machinery and cargo-handling equipment	3	A-III/6
	to apply maintenance and repair of control systems of hotel equipment	3	MASS
	to integrate machinery and equipment after repairs into the remote-control system again and to operate tests accordingly	3	MASS
Additional comments	Most maintenance tasks are to be expected in port. Maintenance job expected to be done by shore-based persons.	os are	

5.1.3 Spare Part Control

Process 5.1.3	Maintenance	in Port – Spare P	art Control			
Scope of	All types of MASS	All types of MASS				
application	 A) Dry Cargo – Container Feeder – short sea 					
	B) Ferry – RoPax – one hour passage					
	C) Dry Cargo – Bulk Carrier	– long distances				
	MASS with crew on board					
	> Remote Operation Centr	e				
	MASS without crew on board					
	> Remote Operation Centr	e				
Process	To get all demanded spare parts	on time to the MAS	S by avoiding too muc	h stock		
objectives						
Process	MASS operators in ROC	Level	in ROC	RACI		
operators	 Senior Navigator 	> Management	> Planning station	R, A		
	> Senior Engineer	> Management	 Planning station 	R		
Interfaces	> Shipping company - operation	ns				
	 Service provider 					
	> Manufacturer					
Event: input	Demand for spare parts based or	n preventive mainte	enance and by unplanne	əd		
	events.					
Process	 Evaluation of demand of spar 	e parts that MASS	keeps to be able to sail			
description	> Planning of specifications, an	nounts, availability,	stocks, delivery			
	> Placing purchase orders to the	e shipping compan	y administration			
	> Control of incoming spare par	rts				
	> Management of stocks on MA	SS or warehouses	or ROC			



Process 5.1.3	Maintenance in Port – Spare Part Control		
Resources	Equipment		
needed	 All systems and equipment on board 		
	 All systems and equipment in ROC 		
Regulations	International regulations		
	MASS flag state and class regulations		
	Local port state and coastal state traffic regulations		
Event: output	All demanded spare parts on time in required specification and amo	ount ava	ilable
Required	The MASS Senior Navigator (management level) is able	C/L	STCW
competences	regarding evaluating (C/L 5) and creating (C/L 6)		
MASS Senior	to evaluate spare part demands and to manage availability to	5	MASS
Navigator	ensure safe operation of MASS		
Management			
Level			
Required	The MASS Senior Engineer (management level) is able	C/L	STCW
competences	regarding evaluating (C/L 5) and creating (C/L 6)		
MASS Senior	to evaluate spare part demands and to manage availability to	5	MASS
Engineer	ensure safe operation of MASS		
Management	to use a digital twin for evaluating the spare part demands	5	MASS
Level			
Additional	<i>...</i>		
comments			

5.2 Maintenance at Sea

Process 5.2		Maintenance at Se	ea		
Scope of	All types of MASS	All types of MASS			
application	A) Dry Cargo – Container	A) Dry Cargo – Container Feeder – short sea			
	B) Ferry – RoPax – one h	B) Ferry – RoPax – one hour passage			
	C) Dry Cargo – Bulk Carri	er – long distances			
	MASS with crew on board				
	> Remote Operation Cer	ntre			
	MASS without crew on board	l			
	> Remote Operation Cer	ntre			
Process	To operate preventive mainten	ance at sea			
objectives					
		1			
Process	MASS operators in ROC	Level	in ROC	RACI	
operators	> Senior Navigator	> Management	> Monitoring station	R, A	
	> Senior Engineer	> Management	> Monitoring station	R	
	> System Administrator	> Operational	> Monitoring station	R	
Interfaces	> Shipping company - operat	ions			
	> Service provider				
	> Manufacturer				
	> Riding crew				
	> Service crew (Ferry only)				
Event: input	Planned maintenance tasks				
Process	 > Inspection of all propulsion 	systems			
description	> Inspection of all machinery	-	ment		

Process 5.2	Maintenance at Sea			
	> Inspection of all safety equipment			
	> Inspection of all navigational and communication equipment			
	 Inspection of all ROC systems 			
	 Updates of software in all systems 			
	> Minor repairs in all systems			
Resources	Equipment			
needed	 All systems and equipment on board 			
	 All systems and equipment in ROC 			
Regulations	International regulations			
	MASS flag state and class regulations			
	Local port state and coastal state traffic regulations			
Event: output	All systems in good working order			
Required	The MASS Navigator (operational level) is able	C/L	STCW	
competences	regarding using and applying (C/L 3) and analysing (C/L 4)			
MASS	to operate remote-controlled maintenance tasks on a MASS	4	MASS	
Navigator	to operate remote system updates of navigational and	4	MASS	
Operational	communication systems			
Level	to apply all settings of the navigational and communication	3	MASS	
	equipment remotely			
	to analyse malfunction alarms and to identify need for	4	MASS	
	corrections			
	to operate maintenance and repairs of MASS systems	3	MASS	
Required	The MASS Senior Navigator (management level) is able	C/L	STCW	
competences	regarding using and applying (C/L 3) and analysing (C/L 4)			
MASS Senior	to manage maintenance, inspection, and repairs of MASS	3	MASS	
Navigator	systems			
Management	regarding evaluating (C/L 5) and creating (C/L 6)			
Level	to evaluate the options for a remote maintenance of	5	MASS	
	navigational and communication equipment	_		
	to evaluate the options for a remote maintenance of MASS	5	MASS	
	structure and deck equipment	_		
	to manage remote maintenance with or without riding crews on	5	MASS	
	board			
	to guide personnel on board to support maintenance and	4	MASS	
	repair tasks		MAGO	
	to report incidents to IT service providers and to track	4	MASS	
	incident/problem management	4	MASS	
	to interoperate with IT service providers and to comply to	4	IVIA33	
	respective service processes	4	MASS	
	to report incidents to IT service providers and to track	4	IVIA33	
Doguirod	incident/problem management The MASS Engineer (operational level) is able …	C/I	STCW	
Required		C/L	SICW	
competences MASS	<i>regarding using and applying (C/L 3) and analysing (C/L 4)</i> to operate maintenance and repair of electrical and electronic	3	A-III/1	
Engineer	to operate maintenance and repair of electrical and electronic equipment	5	A-111/ 1	
Operational		3	A-III/1	
Level	and measuring instruments for fabrication and repair on board	5		
	to expect any interperse and repair of chinks and machinemy	3	A-III/1	
	and equipment			
	to experts remote controlled maintenance tooks on a MACC	3	MASS	
	to explue the estimate of the experiment exploration of the	4	MASS	
	remotely			
	тепносету			



Process 5.2	Maintenance at Sea		
	to analyse malfunction alarms and to identify a need for corrections	4	MASS
Required competences	The MASS Senior Engineer (management level) is able regarding using and applying (C/L 3) and analysing (C/L 4)	C/L	STCW
MASS Senior	to ensure safe working practices	3	A-III/2
Engineer	to manage safe and effective maintenance and repair	3	A-III/2
Management Level	procedures by application of knowledge of marine engineering practice		
	to manage maintenance, inspection and repairs of MASS systems	3	MASS
	regarding evaluating (C/L 5) and creating (C/L 6) to manage safe and effective maintenance and repair procedures	5	A-III/2
	to detect and identify the cause of machinery malfunctions and correct faults	5	A-III/2
	to evaluate the options for a remote maintenance	5	MASS
	to evaluate the options for a remote maintenance of MASS structure and deck equipment	5	MASS
	to manage remote maintenance with or without riding crews on board	5	MASS
	to guide personnel on board to support maintenance and repair tasks	4	MASS
	to report incidents to IT service providers and to track incident/problem management	4	MASS
	to interoperate with IT service providers and to comply to respective service processes	4	MASS
	to report incidents to IT service providers and to track incident/problem management	4	MASS
Required	The MASS System Administrator (operational level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS System	to apply maintenance and repair of electrical and electronic equipment	3	A-III/6
Administrator Operational	to apply maintenance and repair of automation and control systems of main propulsion and auxiliary machinery	3	A-III/6
Level	to apply maintenance and repair of bridge navigation equipment and ship communication systems	3	A-III/6
	to apply maintenance and repair of electrical, electronic, and control systems of deck machinery and cargo-handling equipment	3	A-III/6
	to apply maintenance and repair of control systems of hotel equipment	3	MASS
	to restore system function from backups in case of data loss	4	MASS
	to guide personnel on board to support maintenance and repair tasks	4	MASS
	regarding evaluating (C/L 5) and creating (C/L 6)		
	to evaluate the options for a remote maintenance	5	MASS
	to manage remote maintenance with or without riding crews on board	5	MASS
Additional comments	It is expected that at sea, only preventive maintenance is possible or corrective measures as repairs must be done in port, except of mino Riding crews are to be expected on board.		

6 Malfunctions & Emergencies

6.1 Emergency Preparedness

Process 6.1	Em	ergency Preparedn	ess			
Scope of	All types of MASS					
application	 > Dry Cargo – Container 	Feeder – short sea				
	> Ferry – RoPax – one h	our passage				
	> Dry Cargo – Bulk Carri					
	MASS with crew on board	, .				
	> Remote Operation Cer	tre				
	MASS without crew on board					
	> Remote Operation Cer					
Process	Contingency plans are available		oard and the tea	m in th	e ROC	
objectives	are trained on malfunction and					
Process	MASS operators in ROC	Level	in ROC		RACI	
operators	 Senior Navigator 	> Management	 Planning st 	ation	R, A	
oporatoro	 Senior Engineer 	 Management 	 Planning st 		R	
	 System Administrator 	 Operational 	 Planning st Planning st 		C	
Interfaces	 Shipping company - operati 	•		auon	0	
Intenaces	 Shipping company - operation ROC 	0115				
Eventi input						
Event: input	Risk assessments and regulation	ons				
				0	aifia	
Process	> Evaluate risk assessment m	ntigating measures a	and develop MAS	ss spe	CITIC	
description	contingency plans					
	> Prepare muster lists, role, a					
	> Get approval from shipping			•	d	
	> Set-up trainings for MASS of		e crews on board			
	> Set up trainings for MASS of	•				
	> Plan and operate drills in re	gular sequence on th	ne different emer	gency	and	
	malfunction scenarios					
	> Check of availability of all sa		oard			
	 Check of all safety equipment 	ent in the ROC				
Resources	Equipment					
needed	> Safety systems and equipm	ent				
Regulations	International safety regulations	. ,)			
	MASS flag state and class regu					
Event: output	The operators are prepared for			e, the	MASS	
	and the ROC are well equipped	·	· · ·	1		
Required	The MASS Navigator (operati	•		C/L	STCW	
competences	regarding knowledge (C/L 1) ar	• •	,			
MASS	to explain the content of IAI	MSAR Manual conce	erning search	2	A-II/1	
Navigator	and rescue					
Operational	to explain the specific emer	gency operations for	a MASS with	2	MASS	
Level	and without crew on board					
	regarding using and applying (0	C/L 3) and analysing	(C/L 4)			
	to ensure compliance with p	,	. ,	3	A-II/1	
	by precautions, procedures	•	•			
	prevent, control, and fight fi			3	A-II/1	
	fire-fighting (STCW A-VI/3)	,	~		A-VI/3	
	0 0 ()				_	



Process 6.1	Emergency Preparedness				
	operate life-saving appliances, including survival craft and	3	A-II/1		
	rescue boats (STCW A-VI/2) -> only if crew is on board		A-VI/2		
	apply medical first aid on board ships, including elementary	3	A-II/1		
	first aid (STCW A-VI/4) -> only if crew is on board		A-VI/4		
Required	The MASS Senior Navigator (management level) is able	C/L	STCW		
competences	regarding evaluating (C/L 5) and creating (C/L 6)				
MASS Senior	to maintain safety and security of the ship's crew and	5	A-II/2		
Navigator	passengers and the operational condition of life-saving, fire-				
Management	fighting, and other safety systems				
Level	to develop emergency and damage control plans	5	A-II/2		
	to assess cyber risks and to identify cyber attacks	5	MASS		
	to evaluate the MASS and ROC security-related situation, and	5	MASS		
	to initiate appropriate measures, including STCW A-VI/5		A-VI/5		
	to implement and apply a MASS and ROC security plan	5	MASS		
	to implement concepts of cyber security on board and ashore	5	MASS		
	to manage that all remote-controlled safety equipment is in	5	MASS		
	operational availability				
Required	The MASS Engineer (operational level) is able	C/L	STCW		
competences	regarding knowledge (C/L 1) and understanding (C/L 2)				
MASS	to explain the specific emergency operations for a MASS with	2	MASS		
Engineer	and without crew on board				
Operational	regarding using and applying (C/L 3) and analysing (C/L 4)				
Level	to prevent, control, and fight fires on board, including	3	A-III/1		
	advanced fire-fighting (STCW A-VI/3)		A-VI/3		
	to operate life-saving appliances, including survival craft and	3	A-III/1		
	rescue boats (STCW A-VI/2) -> only if crew is on board		A-VI/2		
	to apply medical first aid on board ship, including elementary	3	A-III/1		
	first aid (STCW A-VI/4) -> only if crew is on board		A-VI/4		
Required	The MASS Senior Engineer (management level) is able	C/L	STCW		
competences	regarding evaluating (C/L 5) and creating (C/L 6)	_			
MASS Senior	to control trim, stability, and stress and to take	5	A-III/2		
Engineer	countermeasures in event of damage to, and consequent				
Management	flooding of a compartment	_			
Level	to maintain safety and security of the ship's crew and	5	A-III/2		
	passengers and the operational condition of lifesaving, fire-				
	fighting and other safety systems	_			
	to develop emergency and damage control plans and handle emergency situations	5	A-III/2		
		F	MAGO		
	operational availability	5	MASS		
	to person owhere violate and to identify owhere attacks	F	MAGG		
	to evolve to the NAACO and DOO as with related either and	5 5	MASS MASS		
	to initiate appropriate measures	5	IVIA33		
	to implement and to apply a MASS and ROC security plan	5	MASS		
		5	MASS		
	to implement concepts of cyber security on board and ashore		IVIAGO		
Required	The MASS System Administrator (operational level) is able	C/L	STCW		
competences	regarding using and applying (C/L 3) and analysing (C/L 4)				
MASS	to explain the specific emergency operations for a MASS with	2	MASS		
System	and without crew on board	_			
Administrator	to prevent, control, and fight fires on board	3	A-III/6		
	to operate life-saving appliances	3	A-III/6		
	to operate intersaving appliances		7111/0		
Process 6.1	Emergency Preparedness				
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Operational	to apply medical first aid on board ship	3	A-III/6		
Level					
Additional	Emergency preparedness includes all malfunctions and emergencies according to				
comments	the risk assessments. Cyber security is also part of emergency preparedness.				

6.2 Malfunction Response

Process 6.2	M	alfunction Respons	e				
Scope of	All types of MASS						
application	> Dry Cargo – Container	Feeder – short sea					
	> Ferry – RoPax – one h	our passage					
	> Dry Cargo – Bulk Carri	er – long distances					
	MASS with crew on board	-					
	> Remote Operation Cen	ntre					
	MASS without crew on board	l					
	> Remote Operation Cen	ntre					
Process	To respond to malfunctions effi	ciently, and to keep th	he MASS in operationa	ıl			
objectives	conditions in case of a malfunc	tion					
Process	MASS operators in ROC	Level	in ROC	RACI			
operators	> Senior Navigator	> Management	> Direct control st.	R, A			
	> Navigator	> Operational	> Direct control st.	С			
	> Senior Engineer	> Management	> Direct control st.	R			
	> Engineer	> Operational	> Direct control st.	С			
	> System Administrator	> Operational	> Direct control st.	С			
Interfaces	> Shipping Company - Opera	tions					
	> Traffic Services						
	> Service providers						
Event: input	Malfunctions of the MASS or R	OC occur					
Process	> use of contingency plan						
description	> set-up of a response organi	sation					
	> initiating measures to get th	e MASS back under	control				
	black out						
	steering gear failure, er	mergency steering					
	loss of engine						
	loss of propulsion						
	extreme list, shifted cargo or equipment						
	spills (SOPEP)						
	failures of sensors and automation devices						
	loss of data connectivity						
	failure of remote-control system						
	extreme weather and e	environmental condition	ons				
Resources	Equipment						
needed	> Contingency plans						
	> Safety equipment on board						
	> All equipment related to the						
Regulations	International regulations and co	odes					
	MASS flag state regulations						
	Local coastal state regulations						
Event: output	MASS is under control						



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Process 6.2	Malfunction Response		
Required	The MASS Navigator (operational level) is able	C/L	STCW
competences	regarding knowledge (C/L 1) and understanding (C/L 2)		
MASS	to explain critical equipment of a MASS and its possible	2	MASS
Navigator	malfunctions		
Operational	to explain how to get critical equipment of a MASS back under	2	MASS
Level	control		
	regarding using and applying (C/L 3) and analysing (C/L 4)		
	to respond to emergencies by applying emergency procedures	3	A-II/1
	to identify malfunctions and to initiate an immediate remote	4	MASS
	response		
Required	The MASS Senior Navigator (management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS Senior	to take actions to protect and safeguard all persons on board	4	A-II/2
Navigator	regarding evaluating (C/L 5) and creating (C/L 6)		
Management	to respond to navigational emergencies	5	A-II/2
Level	to handle emergency situations	5	A-II/2
	to take actions to limit damage and salve the ship following	5	A-II/2
	fire, explosion, collision, or grounding	_	
	to evaluate malfunctions and emergency situations and to	5	MASS
	initiate appropriate measures	_	
	to organize, control, and operate emergency response	5	MASS
	activities in the ROC and on a MASS	_	
	to set-up measures to get the MASS system back under	5	MASS
	control after malfunctions or emergencies	_	
	to manage entering of a MASS not under control (NUC)	5	MASS
Required	The MASS Engineer (operational level) is able	C/L	STCW
competences	regarding knowledge (C/L 1) and understanding (C/L 2)		
MASS	to explain critical equipment of a MASS and its possible	2	MASS
Engineer	malfunctions		
Operational	regarding using and applying (C/L 3) and analysing (C/L 4)		
Level	to perform a take-over in manual control to get the MASS	3	MASS
	system back under control after malfunctions or emergencies		
	occur		
	to apply safety precautions and take action in the event of fire,	3	A-III/1
	with particular reference to oil systems		
	to identify malfunctions and initiate an immediate remote	4	MASS
	response		
Required	The MASS Senior Engineer (management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS Senior	to take actions to protect and safeguard all persons on board	4	A-III/2
Engineer	regarding to evaluating (C/L 5) and creating (C/L 6)	_	
Management	to handle emergency situations	5	A-III/2
Level	to take actions to limit damage and salve the ship following	5	A-III/2
	fire, explosion, collision, or grounding	_	
	to evaluate malfunctions and emergency situations and to	5	MASS
	initiate appropriate measures	_	
	to organize, control, and operate emergency response	5	MASS
	activities in the ROC and on a MASS		
	to set-up measures to get the MASS system back under control after malfunctions or emergencies	5	MASS

Process 6.2	Malfunction Response	Malfunction Response				
Required	The MASS System Administrator (operational level) is able	C/L	STCW			
competences	regarding knowledge (C/L 1) and understanding (C/L 2)					
MASS	to explain critical automation equipment of a MASS and its	2	MASS			
System	possible malfunctions					
Administrator	regarding using and applying (C/L 3) and analysing (C/L 4)					
Operational	to perform a take-over in manual control to get the MASS	3	MASS			
Level	system back under control after malfunctions or emergencies occurred					
	to identify malfunctions and to initiate an immediate remote response	4	MASS			
	to get automation of critical equipment of a MASS back under control	4	MASS			
Additional	The competences to respond to malfunctions and to emergencies a	re quite	e equal			
comments						

6.3 Emergency Response

Process 6.3	Emergency Response					
Scope of	All types of MASS	All types of MASS				
application	> Dry Cargo – Container	Feeder – short sea				
	> Ferry – RoPax – one ho	our passage				
	> Dry Cargo – Bulk Carrie	er – long distances				
	MASS with crew on board	-				
	> Remote Operation Cen	tre				
	MASS without crew on board					
	> Remote Operation Cen	tre				
Process	To response to emergencies ef	ficiently, and to keep	the MASS in operation	nal		
objectives	conditions in case of an emerge	ency.				
Process	MASS operators in ROC	Level	in ROC	RACI		
operators	> Senior Navigator	> Management	> Direct control st.	R, A		
	> Navigator	 Operational 	> Direct control st.	С		
	> Senior Engineer	> Management	> Direct control st.	R		
	> Engineer	 Operational 	> Direct control st.	С		
	> System Administrator	> Operational	> Direct control st.	С		
Interfaces	> MROC					
	> Shipping company - operation	ons				
	> Traffic Services, other vesse					
	> Rescue forces, salvage forc					
Event: input	Emergency of the MASS or RO	C occur				
Process	> use of contingency plan					
description	> set-up of a response organis	sation				
	> initiating measures to get the	e MASS back under	control			
	structural damage					
	water ingress / flooding					
	fire in holds, engine roo	ms, auxiliary rooms	, accommodation			
	medical emergencies					
	cyber attack					
	emergency towing					



Process 6.3	Emergency Response		
	evacuation PAX / service crew / crew		
	person over-board		
	helicopter operations in emergencies		
	SAR support		
Resources	Equipment		
needed	> Contingency plans		
	> Safety equipment on board		
	> All equipment related to the emergency		
Regulations	International regulations and codes		
	MASS flag state regulations		
	Local coastal state regulations		
Event: output	MASS is under control, no persons in danger, no environmental imp	act	
Required	The MASS Navigator (operational level) is able	C/L	STCW
competences	regarding knowledge (C/L 1) and understanding (C/L 2)		
MASS	to explain emergency situations of a MASS and its possible	2	MASS
Navigator	impacts to the MASS		
Operational	regarding using and applying (C/L 3) and analyzing (C/L 4)		
Level	to respond to emergencies by applying emergency procedures	3	A-II/1
	respond to distress signals at sea	3	A-II/1
	to perform a take-over in manual control to get the MASS	3	MASS
	system back under control after malfunctions or emergencies occurred		
	to identify emergency situations and to initiate immediate response	4	MASS
	to ensure security procedures for the MASS at sea and in port	3	MASS
	to explain and apply the applicable and relevant cyber security measures to protect the MASS system	3	MASS
Required competences	The MASS Senior Navigator (management level) is able regarding using and applying (C/L 3) and analysing (C/L 4)	C/L	STCW
MASS Senior Navigator	to take actions to protect and safeguard all persons on board regarding evaluating (C/L 5) and creating (C/L 6)	4	A-II/2
Management Level	to coordinate search and rescue operations according to IAMSAR	5	A-II/2
	to perform duties and assess the ship as a ship security officer	5	A-VI/5
	to respond to navigational emergencies	5	A-II/2
	to manoeuvre and handle a ship in all conditions, especially when launching rescue boats or picking-up survivors	5	A-11/2
	to handle emergency situations	5	A-II/2
	 to take actions to limit damage and salve the ship following fire, explosion, collision, or grounding 	5	A-II/2
	to set-up measures to get the MASS back under control	5	MASS
Required	The MASS Engineer (operational level) is able	C/L	STCW
competences	regarding knowledge (C/L 1) and understanding (C/L 2)		
MASS Engineer	to explain the specific emergency operations for a MASS with and without crew on board	2	MASS
Operational Level	to explain critical equipment of a MASS and its possible malfunctions	2	MASS

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Process 6.3	Emergency Response		
	 regarding using and applying (C/L 3) and analysing (C/L 4) to perform a take-over in manual control to get the MASS system back under control after malfunctions or emergencies 	3	MASS
	occurred to apply safety precautions and take action in event of fire, with particular reference to oil systems	3	A-III/1
	to identify malfunctions and to an initiate immediate remote response	4	MASS
	to ensure security procedures for the MASS at sea and in port	3	MASS
	to explain and apply the applicable and relevant cyber security measures to protect the MASS system	3	MASS
Required competences	The MASS Senior Engineer (management level) is able regarding using and applying (C/L 3) and analysing (C/L 4)	C/L	STCW
MASS Senior Engineer	to take actions to protect and safeguard all persons on board regarding evaluating (C/L 5) and creating (C/L 6)	4	A-III/2
Management	to handle emergency situations	5	A-III/2
Level	to take actions to limit damage and salve the ship following fire, explosion, collision, or grounding	5	A-III/2
	to set-up measures to get the MASS back under control	5	MASS
Required competences	The MASS System Administrator (operational level) is able regarding knowledge (C/L 1) and understanding (C/L 2)	C/L	STCW
MASS System	to explain critical automation equipment of a MASS and its possible malfunctions	2	MASS
Administrator Operational Level	to explain the specific emergency operations for a MASS with and without crew on board <i>regarding using and applying (C/L 3) and analysng (C/L 4)</i>	2	MASS
	to perform a take-over in manual control to get the MASS system back under control after malfunctions or emergencies occur	3	MASS
	to ensure security procedures for the MASS at sea and in port	3	MASS
	to explain and apply the cyber security measures to protect the MASS system	3	MASS
	to identify emergency situations and to initiate an immediate remote response	4	MASS
	to get automation of critical equipment of a MASS back under control	4	MASS
	to implement concepts of cyber security on board and ashore	5	MASS
Additional	The competences to respond to malfunctions and to emergencies a		

Support Processes

S.1 Human Resources – Providing and Developing

Process S.1	Providing an	d Developing Huma	an Resources			
Scope of	All types of MASS					
application	> Dry Cargo – Container	Feeder – short sea				
	> Ferry – RoPax – one hour passage					
	> Dry Cargo – Bulk Carri	ier – long distances				
	MASS with crew on board					
	> Remote Operation Cer	ntre				
	MASS without crew on board	ł				
	> Remote Operation Cer	ntre				
Process	To enable persons to work as I	MASS operator				
objectives						
Process	MASS operators in ROC	Level	in ROC		RACI	
operators	> Senior Navigator	> Management	> Office		R, A	
•	> Senior Engineer	> Management	> Office		R	
Interfaces	> All processes		1			
Event: input	Persons who intend to work as	MASS operator				
		·				
Process	> Ensure the basic competen	ices in maritime safe	ty and security is	ssues		
description	Survival at sea		, ,			
•	Firefighting					
	Personal safety and so	ocial responsibility				
	Security matters	1 7				
	Safety equipment on M	IASS				
	 Ensure the basic competer 		naritime automa	ted and	d	
	autonomous systems					
	Challenges of automat	ion systems				
	Situational awareness	-				
	Fast decision making o		on			
	Workload managemen					
	Stress management					
	 > Ensure communication skills 					
	English for MASS systems, including standard communication phrases					
	Communication in MAS	•		ion più	4303	
	Communication betwee	•	nd other stations	: 25		
	conventional ships and	•		, 40		
Resources	n/a					
needed						
Regulations	International regulations					
0	MASS flag state traffic regulation	ons				
	Occupational health regulation					
Event: output	MASS operators with basic ski					
Required	The MASS Navigator (operation	ional level) is able		C/L	STCW	
competences	regarding knowledge (C/L 1) an	•				
MASS	to explain the challenges for		,	2	MASS	
Navigator	automated systems					
wavigator	automated systems					

Operational	regarding using and applying (C/L 3) and analysing (C/L 4)		
Level	to use SMCP and English in written and oral form	3	A-II/1
	to transmit and receive information by visual signalling (not really necessary)	3	A-II/1
	to take part in GMDSS radio communication, including STCW A-IV/2 as radio operator	3	A-IV/2
	to contribute to the safety of personnel and ship by applying	3	A-II/1
	personal survival techniques, including STCW A-VI/1-1 -> only if crew is on board		A-VI/1
	to contribute to the safety of personnel and ship by explaining	3	A-II/1
	fire prevention and applying firefighting, including STCW A-VI/1-2		A-VI/1
	to contribute to the safety of personnel and ship by	3	A-II/1
	demonstrating personal safety and social responsibility, including STCW A-VI/1-4		A-VI/1
	to explain and to take part in security-related emergency and	3	A-II/1
	contingency procedures, including STCW A-VI/6-1 and 6-2		A-VI/6
	to apply MASS specific safety equipment	3	MASS
	to apply behavioural techniques to keep situational awareness	3	MASS
	and to make decisions when using information by sensors and machines		
	to organize workload and minimise stress when working with automated systems	3	MASS
	to communicate as part of a MASS system with other stations by using standardised phrases	3	MASS
Required	The MASS Senior Navigator (management level) is able	C/L	STCW
competences	regarding evaluating (C/L 5) and creating (C/L 6)	U/L	01011
MASS Senior Navigator	to organise and manage the provision of medical care on board	5	A-II/2
Management	to evaluate the MASS and ROC security-related situation and	5	MASS
Level	to initiate appropriate measures, including STCW A-VI/5		A-VI/5
	to implement and to apply a MASS and ROC security plan		
Required	The MASS Engineer (operational level) is able	C/L	STCW
competences	regarding knowledge (C/L 1) and understanding (C/L 2)		
MASS Engineer	to explain the challenges for humans of highly automated systems	2	MASS
Operational	regarding using and applying (C/L 3) and analysing (C/L 4)		
Level	to use English in written and oral form	3	A-III/1
	to contribute to the safety of personnel and ship by applying	3	A-III/1
	personal survival techniques, including STCW A-VI/1-1 -> only if crew is on board		A-VI/1
	to contribute to the safety of personnel and ship by explaining	3	A-III/1
	fire prevention and applying fire-fighting, including STCW A- VI/1-2		A-VI/1
	to contribute to the safety of personnel and ship by	3	A-III/1
	demonstrating personal safety and social responsibility, including STCW A-VI/1-4		A-VI/1
	to explain and to take part in security-related emergency and	3	A-III/1
	contingency procedures, including STCW A-VI/6		A-VI/6
	to apply MASS specific safety equipment	3	MASS



	to apply behavioural techniques to keep situational awareness and to make decisions when using information by sensors and	3	MASS		
	machines to organise workload and minimise stress when working with automated systems	3	MASS		
	to communicate as part of a MASS system with other stations by using standardised phrases	3	MASS		
	to apply international communication standards for MASS operations	3	MASS		
Required competences	The MASS Senior Engineer (management level) is able regarding evaluating (C/L 5) and creating (C/L 6)	C/L	STCW		
MASS Senior Engineer Management Level	to implement and to apply a MASS and ROC security plan	5	MASS		
Required	The MASS Administrator (operational level) is able	C/L	STCW		
competences MASS Administrator	 regarding knowledge (C/L 1) and understanding (C/L 2) to explain the challenges for humans of highly automated systems 	2	MASS		
Operational Level	regarding using and applying (C/L 3) and analysing (C/L 4) to use English in written and oral form	3	A-III/6		
	to contribute to the safety of personnel and ship by applying personal survival techniques, including STCW A-VI/1-1 -> only if crew is on board	3	A-III/6 A-VI/1		
	to contribute to the safety of personnel and ship by explaining fire prevention and applying fire-fighting, including STCW A-VI/1-2	3	A-III/6 A-VI/1		
	to contribute to the safety of personnel and ship by demonstrating personal safety and social responsibility, including STCW A-VI/1-4	3	A-III/6 A-VI/1		
	to explain and to take part in security-related emergency and contingency procedures, including STCW A-VI/6	3	A-III/6 A-VI/6		
	to apply MASS specific safety equipment	3	MASS		
	to apply behavioural techniques to keep situational awareness and to make decisions when using information by sensors and machines	3	MASS		
	to operate workload and minimise stress when working with automated systems	3	MASS		
	to communicate as part of a MASS system with other stations by using standardised phrases	3	MASS		
Additional	Personal and social capabilities to be integrated and to coordinate v	vith pro	cess		
comments	ents M.2 General Management				

S.2 Legal Aspects

Process S.2	Legal Aspects						
Scope of	All types of MASS						
application	 > Dry Cargo – Container Feeder – short sea 						
	> Ferry – RoPax – one	hour passage					
	> Dry Cargo – Bulk Ca	rrier – long distances	3				
	MASS with crew on board	Ū					
	> Remote Operation C	entre					
	MASS without crew on boa						
	> Remote Operation C	entre					
Process	To ensure compliance with a		and regulations				
objectives		5	5				
Process	MASS operators in ROC	Level	in ROC		RACI		
operators	> Senior Navigator	> Management	> Office		R, A		
	> Navigator	> Operational	> Office		C		
	 Senior Engineer 	> Management	> Office		R		
	> Engineer	 > Operational 	> Office		c		
Interfaces	> All processes	> Operational			U		
Event: input	Operations of MASS system						
Process		all rolevant logiclatic	n and regulations	cuch c	NC		
		•	•		IS		
description	certificates and docu		ternational conver	nions			
	Load Line Conventio	n					
	SOLAS						
	MARPOL						
	International health r	•					
	International instrum	ents affecting safety	of ship passenger	s, crew	, and		
	cargo						
	National legislation for	or implementing inter	national agreeme	nts and			
	conventions						
	> Ensure the application of	all relevant legislation	n and regulations	concer	ning		
	MASS systems, e.g. as						
	MASS flag state regu	ulations					
	ROC state regulations						
	Coastal and port state regulations						
	International agreem	ents on passages of	MASS				
Resources	> All relevant laws and reg	ulations					
needed	_						
Regulations	International regulations (CO	LREG,)					
	MASS flag state traffic regula	ations					
	Local port state and coastal s	state traffic regulatior	าร				
Event: output	Compliance with all legislatio	n and regulations					
Required	The MASS Navigator (operation	-		C/L	STCW		
competences	regarding knowledge (C/L 1)	,					
MASS	to explain international m			2	A-II/1		
Navigator	recommendations						
Operational	to explain national legisla	tion		2	A-II/1		
Level	to explain international ar		gislation and	2	MASS		
	regulation		, .				
	regarding using and applying	r (C/L 3) and analysir	na (C/L 4)	3	A-II/1		
	to monitor compliance with						



Required	The MASS Senior Navigator (management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS Senior Navigator Management	to monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and the protection of the marine environment	4	A-II/2
Level	to apply international and national regulatory framework for MASS and shipping	3	MASS
	to apply national and international regulatory framework for the shore-based operators	3	MASS
	to monitor and control compliance with legislative requirements and measures concerning MASS systems	4	MASS
	 regarding evaluating (C/L 5) and creating (C/L 6) to apply classification cycles for MASS systems and consider intervention schemes requirements 	5	MASS
	to manage MASS system related certificates	5	MASS
Required competences	The MASS Engineer (operational level) is able regarding knowledge (C/L 1) and understanding (C/L 2)	C/L	STCW
MASS Engineer	to explain international and national MASS legislation and regulation	2	MASS
Operational	regarding using and applying (C/L 3) and analysing (C/L 4)		
Level	to monitor compliance with legislative requirements	3	A-III/1
Required	The MASS Senior Engineer (management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)		
MASS Senior Engineer	to apply international and national regulatory framework for MASS and shipping	3	A-III/2
Management Level	to apply national and international regulatory framework for the shore-based operators	3	MASS
	to monitor and control compliance with legislative	4	MASS
	requirements and measures concerning MASS systems to monitor and control compliance with legislative	4	MASS
	requirements and measures to ensure safety of life at sea, security and the protection of the marine environment		
	regarding evaluating (C/L 5) and creating (C/L 6)		
	to apply classification cycles for MASS systems and consider intervention schemes requirements	5	MASS
	to manage MASS system related certificates	5	MASS
Required	The MASS Administrator (operational level) is able	C/L	STCW
competences	regarding knowledge (C/L 1) and understanding (C/L 2)		0.011
MASS	to explain international and national MASS legislation and	2	MASS
Administrator	regulation	_	
Operational Level			
Additional			
Addillonal			

S.3 Automation Systems

Process S.3	Automation Systems				
Scope of	All types of MASS				
application	 A) Dry Cargo – Container Feeder – short sea B) Ferry – RoPax – one hour passage 				
	C) Dry Cargo – Bulk Carrier – long distances				
	MASS with crew on board				
	> Remote Operation Centre				
	MASS without crew on board				
	> Remote Operation Centre				
Process	To provide and operate the MASS and ROC system with an availab	le and	reliable		
objectives	infrastructure for all control and communication systems				
Process	MASS operators in ROC Level in ROC		RACI		
operators	 Senior Navigator Management Planning st 	ation	R, A		
	 System Administrator Operational Planning st 		R		
Interfaces	 The entire control and communication system 	adon			
interfaces	 Experts on IT and communication systems 				
	 Service providers (cloud systems, communication,) 				
Event: input	Commence of operation of the control and communication system				
Event. Input					
Process	Operate the entire system				
description	keep the entire system running				
	> checks and tests				
	> maintain hardware configuration				
	 keep software updated 				
	 check of data interfaces for reliability, consistency, integrity 				
	> securing of data				
Resources	Equipment				
needed	 All systems and equipment on board 				
	> All systems and equipment in ROC				
Regulations	n/a				
Event: output	All systems (hardware and software) can be operated in reliable mo	de			
Required	The MASS Navigator (operational level) is able	C/L	STCW		
competences	regarding knowledge (C/L 1) and understanding (C/L 2)				
MASS	to explain the technical design of a MASS and to name the	2	MASS		
Navigator	differences to a conventional ship				
Operational	to explain the operational design of a remote-control centre for	2	MASS		
Level	a MASS				
	to explain the operational design and components of the	2	MASS		
	workstations with its equipment to control a MASS				
	to explain digital platforms	2	MASS		
	to explain the design, use, and limitations of satellite and	2	MASS		
	cellular networks available to MASS systems				
	to explain the design and use of remote automation control	2	MASS		
	networks				
	to explain the different degrees of autonomy of the	2	MASS		
	navigational and communication systems				
	regarding using and applying (C/L 3) and analysing (C/L 4)	2	MAGO		
	to apply procedures to operate a MASS in different remote-	3	MASS		
	control modes by using the work stations				



	to maintain situational awareness with limited sensor	3	MASS
	availability		
	to operate all navigational and communication controls in the ROC and on the MASS	3	MASS
	to map applications and hardware of automation systems to	4	MASS
	field level, control level, or supervisory level respectively		
	("Automation Pyramid")		
	to name examples of interfaces and protocols being used on each level of automation	4	MASS
Required	The MASS Senior Navigator (management level) is able	C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)	U/L	31000
MASS Senior	to take actions to protect and safeguard all persons on board	4	A-II/2
Navigator	regarding evaluating (C/L 5) and creating (C/L 6)		
Management	to coordinate search and rescue operations according to	5	A-II/2
Level	IAMSAR		
	to perform duties and assess the ship as ship security officer	5	A-VI/5
	to respond to navigational emergencies	5	A-II/2
	to manoeuvre and handle a ship in all conditions, especially	5	A-II/2
	when launching rescue boats or picking-up survivors	_	
	to handle emergency situations	5	A-II/2
	to take actions to limit damage and salve the ship following	5	A-II/2
	fire, explosion, collision or grounding	5	MASS
Required	to set-up measures to get the MASS back under controlThe MASS Engineer (operational level) is able	C/L	STCW
competences	regarding knowledge (C/L 1) and understanding (C/L 2)	U/L	31000
MASS	to explain the technical design of a MASS and to name the	2	MASS
Engineer	differences to a conventional ship		100 100
Operational	to explain the operational design of a remote-control centre for	2	MASS
Level	a MASS		
	to explain the operational design and components of the work	2	MASS
	stations with their equipment to control a MASS		
	to explain digital platforms	2	MASS
	to implement communication brokers to achieve seamless internet access	2	MASS
	regarding using and applying (C/L 3) and analysing (C/L 4)		
	to apply procedures to operate a MASS in different remote-	3	MASS
	control modes by using the work stations		
	to establish operational platforms for information processing,	3	MASS
	also in cooperation with data service providers		
	to operate all engineering controls in the ROC and on the MASS	3	MASS
	to maintain situational awareness with limited sensor	3	MASS
	availability	_	
	to operate the control systems and communication systems for a MASS	3	MASS
	to maintain availability and reliability of the control and communication systems for a MASS	3	MASS
	to map applications and hardware of automation systems to	4	MASS
	field level, control level, or supervisory level respectively		
		1	
	("Automation Pyramid") to name examples of interfaces and protocols being used on	4	MASS

to interoperate with IT service providers and to comply to respective service processes to involve IT service providers and to track related incident/problem management to apply tests and checks and to evaluate the quality of the MASS system performance to decide on appropriate measures to stabilize a MASS control and communication system and to keep it available Required The MASS Senior Engineer (management level) is able	4 4 5	MASS MASS MASS
 to involve IT service providers and to track related incident/problem management to apply tests and checks and to evaluate the quality of the MASS system performance to decide on appropriate measures to stabilize a MASS control and communication system and to keep it available 		
 incident/problem management to apply tests and checks and to evaluate the quality of the MASS system performance to decide on appropriate measures to stabilize a MASS control and communication system and to keep it available 		
MASS system performance to decide on appropriate measures to stabilize a MASS control and communication system and to keep it available	5	MASS
to decide on appropriate measures to stabilize a MASS control and communication system and to keep it available		-
and communication system and to keep it available	_	
	5	MASS
Required I ne wass senior Engineer (management level) is able	C/L	STCW
competences regarding evaluating (C/L 5) and creating (C/L 6)		
MASS Senior to evaluate and ensure the entire control and communication	5	MASS
Engineer system for operating a MASS		
Management to give advice to keep data availability, consistency, and	5	MASS
Level reliability to manage the control systems and communication systems	5	MASS
for a MASS	5	IVIASS
	C/L	STCW
competences regarding knowledge (C/L 1) and understanding (C/L 2)		
MASSto explain the technical design of a MASS and to name theSystemdifferences to a conventional ship	2	MASS
System differences to a conventional ship Administrator to explain the operational design of a remote-control centre for	2	MASS
Operational a MASS	-	
Level to explain the operational design and components of the work	2	MASS
stations with their equipment to control a MASS		
to explain digital platforms	2	MASS
to explain the features of fieldbus standards and their network-	2	MASS
based equivalents to discuss the function of analogue and digital interfaces	2	MASS
between MASS control systems and on-board hardware	_	
to explain the design and use of satellite and cellular networks	2	MASS
available to MASS systems		
to explain the design and use of navigation and	2	MASS
communication networks	2	MASS
to implement communication brokers to achieve seamless internet access	2	MASS
regarding using and applying (C/L 3) and analysing (C/L 4)		
to apply procedures to operate a MASS in different remote-	3	MASS
control modes by using the work stations		
to operate all engineering controls in the ROC and on the	3	MASS
MASS to map applications and hardware of automation systems to	4	MASS
field level, control level, or supervisory level respectively		
("Automation Pyramid")		
to name examples of interfaces and protocols being used on	4	MASS
each level of automation	2	MAGG
to operate the control and communication system for a MASS	3 3	MASS MASS
to maintain availability and reliability of the control and communication system for a MASS		1417 (000
to save all data and information	3	MASS
	3	MASS
to establish operational platforms for information processing,		1
to establish operational platforms for information processing, also in cooperation with data service providers		
	4	MASS



	to involve IT service providers and to track related	4	MASS
	incident/problem management to operate backup facilities to maintain data protection and availability	4	MASS
	to operate on-board facilities for monitoring and	4	MASS
	troubleshooting to improve human-machine interfaces to demands of MASS control	4	MASS
	regarding evaluating (C/L 5) and creating (C/L 6) to apply tests and checks and to evaluate the quality of the MASS system performance	5	MASS
	decide on appropriate measures to stabilise a MASS control and communication system and to keep it available	5	MASS
Additional	Л.		
comments			

S.4 Economic Aspects

Process S.4		Economic Aspects			
Scope of	All types of MASS				
application	D) Dry Cargo – Container Feeder – short sea				
	E) Ferry – RoPax – one hour passage				
	F) Dry Cargo – Bulk Carrier – long distances				
	MASS with crew on board				
	> Remote Operation Centre				
	MASS without crew on board				
	> Remote Operation Cen	tre			
Process	To take economic aspects in th	e operations of a MA	SS system in	ito accou	nt
objectives					
Process	MASS operators in ROC	Level	in ROC		RACI
operators	 Senior Navigator 	> Management	> Planning	g station	R, A
	> Senior Engineer	> Management	> Planning	g station	R
Interfaces	> Shipping company - operations				
Event: input	Decisions on technical and operational improvements				
Process	> Calculations of costs and in	vestments			
description	> Evaluation of operational benefits				
	> Evaluation of impacts on safety of the MASS system				
Resources	n/a				
needed					
Regulations	> n/a				
Event: output	Decisions on technical and ope	rational improvemen	t affecting sat	fety of the	e MASS
	system				
Required	The MASS Senior Navigator (management level) is able			C/L	STCW
competences	regarding using and applying (C/L 3) and analysing (C/L 4)				
MASS Senior	to use remote-controlled resources and infrastructure cost-		3	MASS	
Navigator	effectively and economically				
Management	to determine technical and operational benefits			4	MASS
Level	regarding evaluating (C/L 5) an				
	to evaluate economic effect	s of optimisation mea	asures	5	MASS

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Required competences	The MASS Senior Engineer (management level) is able regarding using and applying (C/L 3) and analysing (C/L 4)	C/L	STCW
MASS Senior Engineer	to use remote-controlled resources and infrastructure cost- effectively and economically	3	MASS
Management Level	to determine technical and operational benefits regarding evaluating (C/L 5) and creating (C/L 6)	4	MASS
	to evaluate economic effects of optimisation measures	5	MASS
Additional	Л.		
comments			

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