



CMOROC Appendix F - Module Catalogue

Identification of Competences for MASS Operators in Remote Operation Centres

V 2.3

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General Prerequisites

Table 1: Compulsory STCW Certificates of Competency for MASS Operators in ROC's

STCW Table	Certificate of Competency	MASS Navigator	MASS Engineer	MASS Senior Navigator	MASS Senior Engineer	MASS System Admin.
A-II/1	Officer in charge of navigational watch (operational level)	X				
A-II/2	Master and Chief Mate (management level)		X			
A-III/1	Engineer in charge of a watch (operational level)			X		
A-III/2	Chief Engineer Second Engineer (management level)				X	
A-III/6	Electro-Technical Officer (operational level)					(X)
A-IV/2	GMDSS Radio Operator	X		X		

Table 2: Compulsory STCW Certificates of Proficiency for MASS Operators in ROC's

STCW Table	Certificate of Proficiency	MASS Navigator	MASS Engineer	MASS Senior Navigator	MASS Senior Engineer	MASS System Admin.
A-VI/1	Basic Safety Training (1-1,1-2,1-4)	X	X	X	X	X
A-VI/2	Survival Craft and Rescue Boats other than Fast Rescue Boats	X	X	X	X	
A-VI/3	Advanced Fire Fighting	X	X	X	X	
A-VI/4	Medical First Aid	X	X	X	X	
A-VI/4	Medical Care			X		
VI/5	Ship Security Officer			X		
A-VI/6-1	Security Awareness Training	X	X	X	X	X
A-VI/6-2	Training for Seafarers with Designated Security Duties	X	X	X	X	

Module Overview

Modules for “MASS ROC Operator Basic Program”

Table 3: Modules "MASS ROC Operator Basic Program"

No.	Module	Summarised Learning Outcome	Comp. Level
1.1.1.	MASS Operations 1	to understand the components of a MASS system, to operate them as part of the system and to interpret the performance	2 - 4
1.1.2.	MASS Safety and Security 1	to be able to contribute to the specific safety and security requirements of a MASS system	3 - 4
1.1.3.	MASS Management and Administration 1	to be able to work in a MASS operator team within legal requirements	2 - 3
1.2.1.	MASS Navigation	to plan and conduct a MASS passage and to take the responsibility on navigation	3 - 4
1.2.2.	MASS Navigation Monitoring	to conduct a safe watch and to take the responsibility of monitoring the MASS system	3 - 4
1.2.3.	MASS Cargo and Mission Operations 1	to monitor cargo and mission operations and to maintain seaworthiness of the MASS	3 - 4
1.3.1.	MASS Engineering Operations 1	to operate all technical systems and automation and to operate remote maintenance	3 - 4
1.3.2.	MASS Automation and Control	to operate automation and autonomy systems and to operate remote maintenance	3 - 4
1.3.3.	MASS Operations Monitoring	to monitor the operations of a fleet of MASS and to intervene appropriately	3 - 4
1.4.1.	In-Service Training 1	to understand the systems and operations in an ROC and on board of a MASS	2 - 3

Modules for “MASS ROC Operator Advanced Program”

Table 4: Modules "MASS Operator Advanced Program"

No.	Module	Summarised Learning Outcome	Comp. Level
2.1.1.	MASS Operations 2	to manage an entire MASS system and to analyse and optimise its performance	4 - 5
2.1.2.	MASS Safety and Security 2	to develop safety and security systems and to maintain safe and secure operation of the entire MASS system	4 - 5
2.1.3.	MASS Management and Administration 2	to develop and improve the entire MASS system and MASS operator teams within legal and economic requirements	4 - 5
2.2.1.	MASS Navigation and Control	to plan and manage MASS voyages and to manoeuvre the MASS in direct control under any condition	4 - 5
2.2.2.	MASS Cargo and Mission Operations 2	to plan, manage, and control cargo and mission operations of the MASS including control of persons on board and seaworthiness of the MASS	4 - 5
2.3.1.	MASS Engineering Operations 2	to manage all technical systems and automation, and to improve reliability, availability, performance, and resilience of the entire MASS system	4 - 5
2.3.2.	MASS Operations Control	to manage a fleet of MASS and to take direct control of a MASS on demand to apply appropriate measures to keep all systems in proper working condition	4 - 5
2.4.1.	Practical Training 2	to evaluate the performance and critical conditions in ROC and on board of a MASS	4 - 5

Arrangement of Modules in the Training Programs

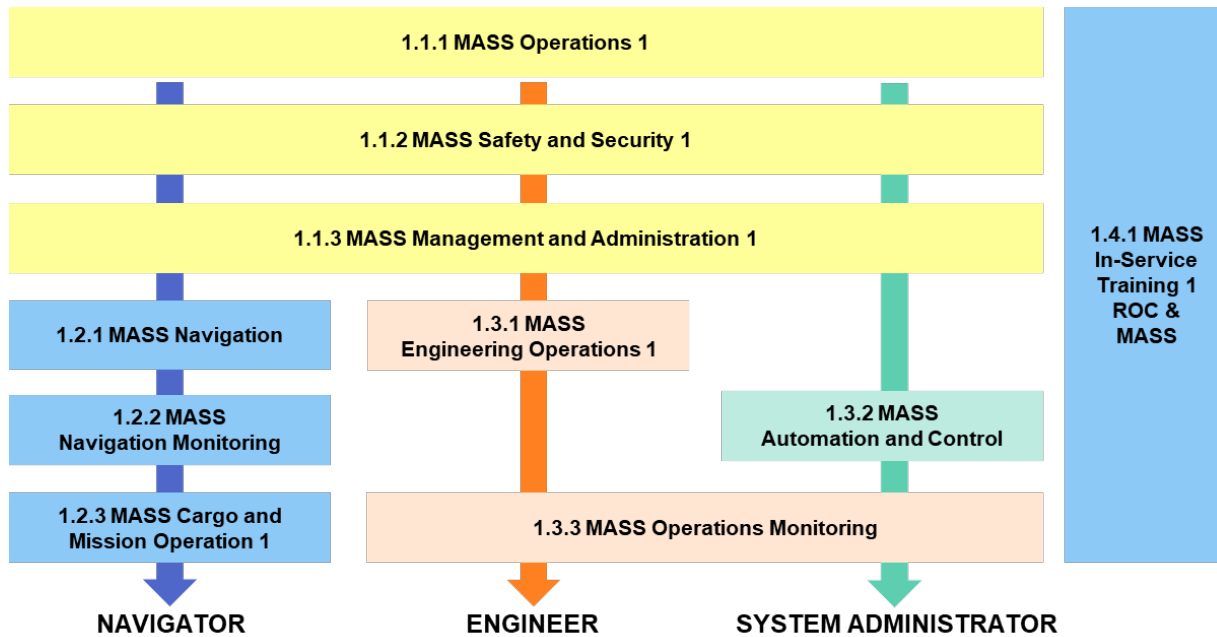


Figure 1: Arrangement of Modules "MASS ROC Operator Basic Program"

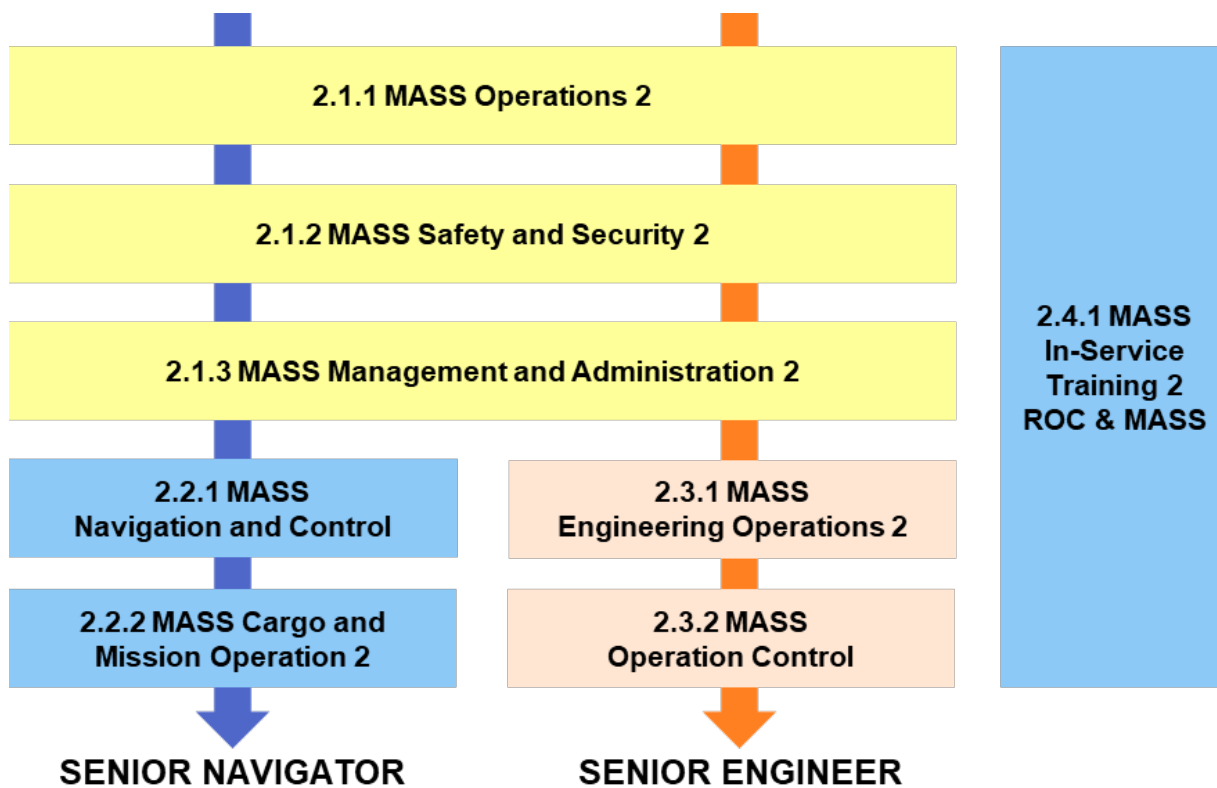


Figure 2: Arrangement of Modules "MASS ROC Operator Advanced Program"

1. Modules “MASS ROC Operators Basic Program”

1.1 MASS ROC Operators – modules for all operators

1.1.1 MASS Operations 1

1.1.1. MASS Operations 1 (OPS 1)					
Total workload (h):	128h	Lectures (h):	64h	Simulator (h):	24h
Exercises (h):	12h	Examination (h)	4h	Self-Studies (h):	16h
Scope und frequency of teaching:	16 class lectures (4h) 3 days simulator training (8h) 3 classes exercises (4h)		All operators at operational level: ▪ Navigators ▪ Engineers ▪ System Administrators		
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding knowledge and understanding (extension, consolidation, and understanding of knowledge))</i> <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... operate a MASS system (CL 2 - 4) ... document and analyse data of a MASS system (CL 3 - 4) ... interpret system data (CL 2 - 4) ... use communication networks for remote control (CL 2 - 4) <i>(regarding communication and cooperation)</i> ... communicate technical and operational aspects of MASS systems ... share aspects of MASS systems with other persons <i>(regarding reflection of professional identity)</i> ... contribute with consolidated technical and operational background to the operations of MASS <i>Consider MASS competence tables for details.</i>					
Course content (lecture): Design of MASS systems ▪ Design and operating structures of MASS ▪ Design and operating structures of Remote Operation Centres ▪ Operation of controls for navigation, engineering and communication ▪ Interfaces to local sensor systems, automated facility services, and planned response services Levels of automation and autonomy ▪ Field level, control level, supervisory level ▪ Hardware and automation systems ▪ Interfaces and protocols Communication and digital networks ▪ Design and use of satellite and terrestrial networks ▪ Use of digital platforms ▪ Availability and reliability of networks Data management ▪ Data exchange and data bases of a MASS system ▪ Consistency of data ▪ Data produced by artificial intelligence ▪ Data analysis ▪ Relevant data and parameters reflecting operational states of MASS systems ▪ Setting of parameters and limitations for a MASS system					Hours: 16h 16h 12h 20h
Exercise content:					

Module-related exercises (as examples and suggestion) ▪ e.g., definition of a MASS system for specific use cases ▪ e.g., analysing data for a specific application ▪ e.g., description of digital application for a MASS system		12h		
Simulator training ▪ Familiarisation with workstations for planning, monitoring, and controlling ▪ Familiarisation with automated systems ▪ Familiarisation with data management		24h		
Language of teaching:	English			
Prerequisites:	Qualification according to STCW requirements for navigational officers or engineers on operational level			
Teaching facility and equipment:	> For lectures: classroom with audio-visual presentation systems > For module-related exercises: workstations with access to digital twins for exemplary use cases > For simulator training: ROC-simulator with planning, monitoring, and direct control stations			
Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.			
Further information:	Module represents a basic course for navigators, engineers, and system administrators operating a MASS.			
Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
1.1.1.1. MASS system	Person competent in MASS technologies	32h	Seminar Style Lecture (SL)	Written Test (WT) (≈1.5h), or Module Paper (MP) (≈10,000 words or ≈20 p.), Graded
1.1.1.2. Network and Data Management	Person competent in data networks	32h	Seminar Style Lecture (SL)	Written Test (WT) (≈1.5h), or Module Paper (MP) (≈10,000 words or ≈20 p.), graded
1.1.1.3. Module related exercises	Person competent in ROC operations	12h	Guided Exercises (MRE)	Practical Examination (PE), Successful participation in exercises
1.1.1.4. Simulator training	Person competent in ROC operations	24h	Simulator Exercises (SIM)	Practical Examination (PE), successful participation in exercises

1.1.2 MASS Safety and Security 1

1.1.2. MASS Safety and Security 1 (SAS 1)					
Total workload (h):	78h	Lectures (h):	36h	Simulator (h):	16h
Exercises (h):	8h	Examination (h)	2h	Self Studies (h):	16h
Scope und frequency of teaching:		9 class lectures (4h) 2 days simulator training (8h) 2 classes exercises (4h)		All operators at operational level: ▪ Navigators ▪ Engineers ▪ System Administrators	
Learning outcomes:					
Upon successful completion of this module, participants are expected to be able to ...					
(regarding knowledge and understanding (extension, consolidation, and understanding of knowledge))					
(regarding using, applying, and generating knowledge (applying and transferring knowledge))					
... contribute to the safety of personnel and MASS (CL 2 – 4)					
... contribute to the security of personnel and MASS (CL 2 – 4)					
(regarding communication and cooperation)					
... communicate efficiently in malfunction and emergency situations					
... be part of a MASS emergency response team					
... apply an efficient cooperation between MASS and ROC					
(regarding reflection of professional identity)					
... take responsibility for the safety and security of a MASS					
Consider MASS competence tables for details.					
Course content (lecture):					Hours:
Specific malfunctions and emergency situations for a MASS and an ROC ▪ Fire ▪ Collision, grounding, structural failure, water ingress ▪ Cyber attacks ▪ Loss of data connectivity, failures of sensors and automation devices, failure of remote-control system ▪ Loss of propulsion, steering gear failure, black-out ▪ Extreme list, extreme weather, and environmental conditions ▪ Incidents with persons on board of a MASS					8h
Emergency preparedness MASS and ROC ▪ Contingency plans for MASS ▪ MASS-specific content of contingency plans ▪ MASS specific and remote-controlled safety equipment and its application on a MASS					8h
Emergency response ▪ Remote identification and response on malfunctions and emergencies ▪ Emergency towing and helicopter operations ▪ Coordination between ROC, MASS, other ships, VTS and other parties					8h
Security of a MASS ▪ Remote controlled security procedures at sea and in port ▪ Control access and stay of persons on board of a MASS ▪ Risks by cyber security					12h
Exercise content:					
Module-related exercises (as examples and suggestion) ▪ e.g. development of a MASS-specific contingency plan ▪ e.g. case study on malfunction or emergency response ▪ e.g. development of a MASS-specific security plan					8h

Simulator training - Remote response exercises on malfunctions - Remote response exercises on emergency situations - Procedural training for ROC operators - Procedural training in coordination of ROC with a crew on board				16h
Language of teaching:	English			
Prerequisites:	Qualification according to STCW requirements for navigational officers or engineers on operational level			
Teaching facility and equipment:	> For lectures: classroom with audio-visual presentation systems > For module-related exercises: documentation of exemplary MASS systems > For simulator training: ROC-simulator with emergency response stations			
Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.			
Further information:	Module represents a basic course for Navigators, Engineers and System Administrators operating a MASS.			
Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
1.1.2.1. MASS-System Safety 1	Person competent in ROC and MASS safety	24h	Seminar Style Lecture (SL)	Written Test (WT) (≈1.5h), or Module Paper (MP) (≈10,000 words or ≈20 p.), graded
1.1.2.2. MASS-System Security 1	Person competent in security and cyber risks	12h	Seminar Style Lecture (SL)	Written Test (WT) (≈1.5h), or Module Paper (MP) (≈10,000 words or ≈20 p.), graded
1.1.2.3. Module related exercises	Person competent in ROC and MASS operations	8h	Guided Exercises (MRE)	Practical Examination (PE), Successful participation in exercises
1.1.2.4. Simulator training	Person competent in ROC and MASS safety	16h	Simulator Exercises (SIM)	Practical Examination (PE), Successful participation in exercises

1.1.3 MASS Management and Administration 1

1.1.3. MASS Management and Administration 1 (MMA 1)					
Total workload (h):	74h	Lectures (h):	40h	Simulator (h):	./h
Exercises (h):	16h	Examination (h)	2h	Self Studies (h):	16h
Scope und frequency of teaching:		10 class lectures (4h) 4 classes exercises (4h)		All operators at operational level: ▪ Navigators, ▪ Engineers, ▪ System Administrators	
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding knowledge and understanding (extension, consolidation, and understanding of knowledge))</i> <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... Application of leadership and teamworking skills (CL 2 – 3) ... Apply MASS related management systems (CL 2 – 3) ... Apply MASS related risk management (CL 4) ... Monitor compliance with legislative requirements (CL 2) <i>(regarding communication and cooperation)</i> ... Apply an efficient communication within MASS teams ... Contribute to safe, secure and efficient operations as a part of a MASS team <i>(regarding reflection of professional identity)</i> ... Take over responsibility as a MASS operator for an efficient and reliable MASS system <i>Consider MASS competence tables for details.</i>					
Course content (lecture): Leadership and teamwork in a MASS system ▪ Team structures and distribution of responsibilities in ROC and on MASS ▪ Challenges of remote-controlled systems and how they affect leadership and teamwork ▪ Communication in MASS-teams ▪ Workload management in MASS-teams MASS-related management systems ▪ Management systems with influence on MASS quality and performance ▪ Management objectives for a MASS system ▪ Monitoring and improving the quality and performance of a MASS system MASS-related risk management ▪ Operational risks of a MASS system ▪ Mitigating risks in MASS systems Legislative framework for MASS systems ▪ International MASS legislation and regulation ▪ National MASS legislation and regulation					Hours: 12h 12h 8h 8h
Exercise content: Module-related exercises (as examples and suggestion) ▪ e.g. role-play for ROC functions and procedures ▪ e.g. developing for a MASS use case an exemplary content of a management system ▪ e.g. analysing case studies on legal questions					16h
Language of teaching:		English			
Prerequisites:		Qualification according to STCW requirements for navigational officers or engineers on operational level			
Teaching facility and equipment:		> For lectures and module-related exercises: classroom with audio-visual presentation systems			

Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.			
Further information:	Module represents a basic course for navigators, engineers and system administrators operating a MASS.			
Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
1.1.3.1. MASS Resource Management	Person competent in human-related sciences	12h	Seminar Style Lecture (SL)	Oral Exam. (OE) (≈20 min), or Oral Present. (OP) (≈20 min) or Written Test (WT) (≈1 h), graded
1.1.3.2. MASS Management	Person competent in management systems	20h	Seminar Style Lecture (SL)	Written Test (WT) (≈1.5h), graded
1.1.3.3. MASS Legislation	Person competent in legislation	8h	Seminar Style Lecture (SL)	Written Test (WT) (≈1.5h), graded
1.1.3.4. Module related exercises	Person competent in MASS management	8h	Guided Exercises (MRE)	Practical Examination (PE), successful participation in exercises

1.2 MASS ROC Navigators

1.2.1 MASS Navigation

1.2.1 MASS Navigation (NAV)					
Total workload (h):	128h	Lectures (h):	56h	Simulator (h):	24h
Exercises (h):	16h	Examination (h)	4h	Self Studies (h):	28h
Scope und frequency of teaching:		14 class lectures (4h) 3 days simulator exercises (8h) 4 classes exercises (4h)		Navigators at operational level	
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... Operate navigational and communication MASS systems (CL 2 - 3) ... Plan and conduct a MASS passage (CL 4) ... Determine position and status of MASS (CL 2 - 4) ... Handle a MASS in monitoring mode (CL 3 - 4) <i>(regarding communication and cooperation)</i> ... Take part in the communication of navigational status of the MASS ... Cooperate with other operational team members to control navigation of a fleet of MASS <i>(regarding reflection of professional identity)</i> ... Take over responsibilities to navigate a fleet of MASS <i>Consider MASS competence tables for details.</i>					
Course content (lecture): Operation of MASS navigation and communication systems - Automation and control systems - Navigation systems - Sensor systems - Communication systems - Integration of all systems MASS navigation and manoeuvring - MASS passage planning - Control of position, course and speed - MASS handling and manoeuvring to avoid collisions and to sail the planned track					Hours: 24h 32h
Exercise content: Module-related exercises (as examples and suggestion) - e.g. navigation exercises - e.g. communication exercises - e.g. case studies on sensor systems on a MASS Simulator training - Passage planning for MASS - Remote navigation and interpretation of navigation and communication information - Handling of a MASS in monitoring mode, manoeuvring on pilotage and sea passage					16h 24h
Language of teaching:		English			
Prerequisites:		Qualification according to STCW requirements for navigational officers on operational level			
Teaching facility and equipment:		> For lectures: classroom with audio-visual presentation systems > For module-related exercises: workstations with access to electronic navigation and communication systems > For simulator training: ROC-simulator with planning, monitoring, and direct control stations			

Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.			
Further information:	Module represents a basic course for navigators operating a MASS.			
Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
1.2.1.1. MASS Navigation	Person competent in MASS Navigation	56 h	Seminar Style Lecture (SL)	Written Test (WT) (≈ 3 h), graded
1.2.1.2. Module related exercises	Person competent in MASS navigation	16 h	Guided Exercises (MRE)	Practical Examination (PE), successful participation in exercises
1.2.1.3. Simulator training	Person competent in MASS navigation	24 h	Simulator Exercises (SIM)	Practical Examination (PE), successful participation in exercises

1.2.2 MASS Navigation Monitoring

1.2.2 MASS Navigation Monitoring (NAMO)					
Total workload (h):	98h	Lectures (h):	48h	Simulator (h):	24h
Exercises (h):	8h	Examination (h)	2h	Self Studies (h):	16h
Scope und frequency of teaching:		12 class lectures (4h) 3 days simulator training (8h) 2 classes exercises (4h)		Navigators at operational level	
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... Conduct and maintain a safe remote navigational watch (CL 3 - 4) ... Monitor and control the navigation of a MASS (CL 4) ... Operate human-machine interfaces (CL 3) ... Communicate as MASS with other stations or automated systems (CL 3 - 4) ... Maintain all navigational and communication equipment (CL 4) <i>(regarding communication and cooperation)</i> ... Take part in the communication of navigational and monitoring status of the MASS ... Take over the monitoring of a fleet of MASS in cooperation with other operational team members <i>(regarding reflection of professional identity)</i> ... Take over the role of a monitoring operator and take the responsibilities <i>Consider MASS competence tables for details.</i>					
Course content (lecture): MASS monitoring ▪ Maintaining a safe and remote navigational watch ▪ Monitoring of navigational parameters in remote control ▪ Monitoring the status of automation and reliability of data ▪ Procedures in ROC and on MASS (e.g. preparation passage, system checks, monitoring, interventions, take-overs) ▪ Maintaining situational awareness ▪ Communication between MASS, ROC and other stations MASS Maintenance of navigational and communication equipment ▪ Remote system updates ▪ Analysis of alarms and malfunctions ▪ Remote maintenance procedures					Hours: 36h 12h
Exercise content: Module-related exercises (as examples and suggestion) ▪ e.g. analysing case studies on different types of MASS ▪ e.g. communication exercises ▪ e.g. developing procedures for exemplary types of MASS and levels of autonomy Simulator training ▪ Monitoring of one MASS and a fleet of MASS in different levels of autonomy ▪ Identification of deviations from limiting parameters and intervention procedures ▪ Change over from monitoring to direct control and back					8h 24h
Language of teaching:		English			
Prerequisites:		Qualification according to STCW requirements for navigational officers on operational level			

Teaching facility and equipment:	> For lectures: classroom with audio-visual presentation systems > For module-related exercises: workstations with access to digital twins for exemplary use cases > For simulator training: ROC-simulator with planning, monitoring, and direct control stations			
Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.			
Further information:	Module represents a basic course for navigators operating a MASS.			
Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
1.2.2.1. MASS Monitoring	Person competent in MASS Navigation	48h	Seminar Style Lecture (SL), or Project (P)	Written Test (WT) (≈ 2h), or Project Report (PR) (≈7,000 words or ≈15 p.), graded
1.2.2.2. Module related exercises	Person competent in MASS navigation	8h	Guided Exercises (MRE)	Practical Examination (PE), successful participation in exercises
1.2.2.3. Simulator training	Person competent in MASS navigation	24h	Simulator Exercises (SIM)	Practical Examination (PE), successful participation in exercises

1.2.3 MASS Cargo and Mission Operations 1

1.2.3. MASS Cargo and Mission Operations 1 (CMO 1)					
Total workload (h):	94h	Lectures (h):	40h	Simulator (h):	./.
Exercises (h):	24h	Examination (h)	4h	Self Studies (h):	26h
Scope und frequency of teaching:	10 class lectures (4h) 6 classes exercises (4h)			Navigators at operational level	
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... Monitor automated cargo and mission operations (CL 3) ... Operate the specific MASS equipment remotely (CL 3) ... Maintain seaworthiness of MASS (CL 3) ... Operate remote ballasting systems (3) ... Keep stability, trim, and strength within limitations (CL 4) ... Inspect and report defects and damage to MASS structures (CL 4) <i>(regarding communication and cooperation)</i> ... Communicate cargo and mission operations with external parties and institutions ... Cooperate as part of the MASS team with all team members <i>(regarding reflection of professional identity)</i> ... Take over the responsibility for monitoring of cargo and mission operations <i>Consider MASS competence tables for details.</i>					
Course content: Cargo and mission operations of MASS - Automated cargo and mission systems of MASS - Interfaces between MASS and terminals - Roles and distribution of tasks in port operations - Remote-controlled cargo care at sea MASS seaworthiness - MASS structures and deck equipment - Inspection for defects and damages at MASS structures and deck equipment - Remote monitoring of stability, trim, and strength - Remote controlled ballasting systems - Remote monitoring of cargo securing					Hours: 20h 20h
Exercise content: Module-related exercises (as examples and suggestion) - e.g. case studies on planning of cargo loading for different types of MASS - e.g. case studies on procedures for remote-controlled cargo operations - e.g. exercises on remote-controlled stability systems of MASS					24h
Language of teaching:	English				
Prerequisites:	Qualification according to STCW requirements for navigational officers on operational level				
Teaching facility and equipment:	> For lectures: classroom with audio-visual presentation systems > For module-related exercises: workstations with access to exemplary use cases and a stability calculator for a MASS				
Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.				
Further information:	Module represents a basic course for navigators operating a MASS.				

Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
1.2.3.1. Cargo and Mission Operations	Person competent in cargo and mission operations	40h	Seminar Style Lecture (SL)	Written Test (WT) (≈ 3h), or Module Paper (MP) (≈10,000 words or ≈20 p.), graded
1.2.3.2. Module related exercises	Person competent in cargo and mission operations	24 h	Guided Exercises (MRE)	Practical Examination (PE), successful participation in exercises

1.3 MASS ROC Engineers and System Administrators

1.3.1 MASS Engineering Operations 1

1.3.1. MASS Engineering Operations (ENG 1)					
Total workload (h):	162h	Lectures (h):	80h	Simulator (h):	12h
Exercises (h):	24h	Examination (h)	4h	Self Studies (h):	42h
Scope und frequency of teaching:	20 class lectures (4h) 1.5 days simulator (8h) 6 classes exercises (4h)			Engineers at operational level	
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... Operate propulsion and auxiliary MASS systems (CL 2 - 3) ... Operate automation and autonomy of MASS systems (CL 3 - 5) ... Analyse maintenance demands (CL 4) ... Operate maintenance and repair of MASS (CL 3) <i>(regarding communication and cooperation)</i> ... Take part in the communication of the operational status of the MASS ... Cooperate as a team member for operational engineering <i>(regarding reflection of professional identity)</i> ... Take over the responsibility for operating the technical equipment of a MASS <i>Consider MASS competence tables for details.</i>					
Course content (lecture): MASS propulsion systems and its operation - Operation of remote-control system - Electrical propulsion systems on MASS and electric power storage systems - Combustion engines on MASS and alternative fuel storage systems - Remote-controlled propulsion and thruster systems - Specific performance parameters and limitations MASS auxiliary systems and its operation - Sensor systems and their application - Alternative power generation systems (wind, solar energy) - MASS specific auxiliary systems - Bunkering and disposal - MASS deck and safety systems - Automated port facilities MASS and ROC automation systems and its operation - Degrees of automation and autonomy - Remote control systems - Limitations, reliability, availability, resilience of automated and autonomous systems - Performance control Maintenance - Remote-controlled inspection and remote analysis of system parameters - Remote-controlled maintenance operations on a MASS - Testing of machinery and equipment and restarts of systems					Hours: 20h 12h 16h 32h
Exercise content: Module-related exercises (as examples and suggestion) - e.g. analysing operational scenarios on different propulsion systems - e.g. analysing exemplary operational scenarios for performance figures - e.g. development of maintenance strategies for exemplary critical equipment - e.g. procedural training on coordination of inspections and maintenance tasks					24h

Simulator training Exercises on control of performance for exemplary MASS systems with different propulsion systems				12h
Language of teaching:	English			
Prerequisites:	Qualification according to STCW requirements for engineers on operational level			
Teaching facility and equipment:	> For lectures: classroom with audio-visual presentation systems > For module-related exercises: workstations with access to digital twins for exemplary use cases > For simulator training: ROC-MASS systems simulator with all performance indicators			
Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.			
Further information:	Module represents a basic course for engineers operating a MASS, system administrators take the module 1.3.2 Automation & Control.			
Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
1.3.1.1. Engineering Operations	Person competent in MASS technologies	32h	Seminar Style Lecture (SL)	Written Test (WT) (≈ 1.5h), graded
1.3.1.2. Automation Systems	Person competent in MASS automation	16h	Seminar Style Lecture (SL)	Written Test (WT) (≈ 1.5h), graded
1.3.1.3. Operational Maintenance	Person competent in MASS maintenance	32h	Seminar Style Lecture (SL)	Written Test (WT) (≈ 1.5h), graded
1.3.1.4. Module related exercises	Person competent in MASS technologies	24 h	Guided Exercises (MRE)	Practical Examination (PE), successful participation in exercises
1.3.1.5. Simulator training	Person competent in MASS technologies	12h	Simulator Exercises (SIM)	Practical Examination (PE), successful participation in exercises

1.3.2 MASS Automation and Control

1.3.2. MASS Automation and Control (AUC)					
Total workload (h):	162h	Lectures (h):	80h	Simulator (h):	12h
Exercises (h):	24h	Examination (h)	4h	Self Studies (h):	42h
Scope und frequency of teaching:	20 class lectures (4h) 1.5 days simulator (8h) 6 classes exercises (4h)			System Administrators at operational level	
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... Operate automation and autonomy of MASS systems (CL 3) ... Establish integration of service providers (CL 4) ... Analyse maintenance demands (CL 4) ... Operate maintenance and repair of MASS control systems (CL 3-4) <i>(regarding communication and cooperation)</i> ... Take part in the communication of the operational status of the MASS ... Cooperate as a team member for MASS automation, control and data management <i>(regarding reflection of professional identity)</i> ... Take over the responsibility for operating the automation and control systems of a MASS <i>Consider MASS competence tables for details.</i>					
Course content (lecture): MASS electrical systems and its operation ▪ Electrical propulsion and electric power storage systems on MASS ▪ Auxiliary power on a MASS and in ROC ▪ Specific performance parameters and limitations MASS and ROC automation and control systems and its operation ▪ Degrees of automation and autonomy ▪ Automation and control systems ▪ Digital interfaces between ROC, MASS and external applications ▪ Navigation and communication networks ▪ Limitations, reliability, availability, resilience of automated and autonomous systems ▪ Backup facilities in ROC and on board MASS data analysis ▪ Data structuring and analysis ▪ Derivation of baselines for limitations and alarms ▪ Evaluation of consistency and reliability of MASS data Integration of service providers ▪ Operational platforms for information processing ▪ Interoperation with service providers Maintenance ▪ Remote-controlled inspection and maintenance operations on a MASS ▪ Maintenance strategies and derivation of maintenance activities ▪ Identification of root causes of failures by remote analysis of system parameters and protocols ▪ Restoring of system functions from backups in case of data loss ▪ Integration of service providers ▪ Remote guidance of persons on board to operate maintenance and repair					Hours: 20h 20h 8h 16h 16h

Exercise content:				
Module-related exercises (as examples and suggestion) ▪ e.g. analysing operational scenarios on automation and control systems ▪ e.g. analysing exemplary operational scenarios for performance figures ▪ e.g. development of maintenance strategies for exemplary critical equipment ▪ e.g. procedural training on coordination of inspections and maintenance tasks		24h		
Simulator training ▪ Exercises on control of performance for exemplary MASS systems with different systems		12h		
Language of teaching:	English			
Prerequisites:	Qualification according to STCW requirements for ETO’s on operational level or equivalent			
Teaching facility and equipment:	> For lectures: classroom with audio-visual presentation systems > For module-related exercises: workstations with access to digital twins for exemplary use cases > For simulator training: ROC-MASS systems simulator with all performance indicators			
Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.			
Further information:	Module represents a basic course for system administrators operating a MASS, engineers take the module 1.3.1 Engineering Operations			
Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
1.3.2.1. Automation and Control	Person competent in MASS automation	40h	Seminar Style Lecture (SL)	Written Test (WT) (≈ 1.5h), graded
1.3.2.2. Data Management	Person competent in MASS data information systems	24h	Seminar Style Lecture (SL)	Written Test (WT) (≈ 1.5h), graded
1.3.2.3. Operational Maintenance	Person competent in MASS maintenance	16h	Seminar Style Lecture (SL)	Written Test (WT) (≈ 1.5h), graded
1.3.2.4. Module related exercises	Person competent in MASS technologies	24 h	Guided Exercises (MRE)	Practical Examination (PE), successful participation in exercises
1.3.2.5. Simulator training	Person competent in MASS technologies	12h	Simulator Exercises (SIM)	Practical Examination (PE), successful participation in exercises

1.3.3 MASS Operations Monitoring

1.3.3. MASS Operations Monitoring (MOM)					
Total workload (h):	158h	Lectures (h):	64h	Simulator (h):	36h
Exercises (h):	24h	Examination (h)	4h	Self Studies (h):	30h
Scope und frequency of teaching:		16 class lectures (4h) 4.5 days simulator training (8h) 6 classes exercises (4h)		Engineers and System Administrators at operational level	
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... Monitor a MASS system (CL 4) ... Conduct and maintain a safe remote engineering watch (CL 3 - 4) ... Operate human-machine-interfaces (HMI) (CL 3) ... Communicate as MASS with other and automated stations (CL 3 -4) <i>(regarding communication and cooperation)</i> ... Communicate the operational status of the MASS with team members and external parties ... Cooperate as a team member in MASS monitoring <i>(regarding reflection of professional identity)</i> ... Take over the responsibility to monitor the operational status of a MASS <i>Consider MASS competence tables for details.</i>					
Course content (lecture): Monitoring of MASS systems - Remote control and performance monitoring - MASS system performance figures - Monitoring procedures - Assessment of systems availability and reliability - Check of sensors and data quality - Interpretation of alarms and failure messages - Interventions in case of critical deviations from set limitations - Change from monitoring to direct control and back Human-Machine-Interface - Workstation design - Sensor systems and reliability of data - Monitoring a fleet of MASS - Information presentation and human perception - Maintaining situational awareness Communication with other stations - Communication systems between ROC and MASS - Communication systems with other stations - Monitoring data communication					Hours: 40h 16h 8h
Exercise content: Module-related exercises (as examples and suggestion) - e.g. analysing case studies on different propulsion systems of MASS - e.g. communication exercises - e.g. developing procedures for exemplary propulsion systems of MASS and levels of autonomy Simulator training - Monitoring of one MASS and a fleet of MASS in different levels of autonomy - Identification of deviations from limiting parameters and intervention procedures - Change over from monitoring to direct control and back					24h 36h

Language of teaching:	English
Prerequisites:	Qualification according to STCW requirements for engineers or ETO's on operational level
Teaching facility and equipment:	> For lectures: classroom with audio-visual presentation systems > For module-related exercises: workstations with access to digital twins for exemplary use cases > For simulator training: ROC-simulator with planning, monitoring and direct control stations
Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.
Further information:	Module represents a basic course for engineers and system administrators operating a MASS.

Courses of the module

Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
1.3.3.1. MASS Monitoring	Person competent in ROC operations	48h	Seminar Style Lecture (SL), or Project (P)	Written Test (WT) (≈ 2h), or Project Report (PR) (≈7,000 words or ≈15 p.), graded
1.3.3.2. Human-Machine Interface	Person competent in human-machine interfaces	16h	Seminar Style Lecture (SL)	Oral Exam. (OE) (≈20 min), or Oral Present. (OP) (≈20 min) or Written Test (WT) (≈1 h), graded
1.3.3.3. Module related exercises	Person competent in MASS monitoring	30h	Guided Exercises (MRE)	Practical Examination (PE), successful participation in exercises
1.3.3.4. Simulator training	Person competent in MASS monitoring	36h	Simulator Exercises (SIM)	Practical Examination (PE), successful participation in exercises

1.4 MASS ROC Operators – In-Service Training

1.4.1 MASS In-Service Training 1

1.4.1. MASS In-Service Training 1 (IST 1)					
Total workload (h):		600h	Lectures (h):		./.
Exercises (h):		480h	Examination (h)		./.
Scope und frequency of teaching:		12 weeks (60 days)		All operators at operational level: ▪ Navigators, ▪ Engineers, ▪ System Administrators	
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... Describe the operation of a MASS system (CL 2) ... Describe automation systems of a MASS system (CL 2) ... Apply theoretical contents of theory modules to the real operations in an ROC and on board of a MASS (CL 3) ... Apply experienced operational and emergency procedures (CL 3) <i>(regarding communication and cooperation)</i> ... Be convinced to work in teams to control a MASS ... Cooperate as a team member for MASS operations <i>(regarding reflection of professional identity)</i> ... Take over responsibility on tasks to control a MASS					
Course content: Gain experience in ROC ▪ Taking over of monitoring tasks in an ROC under supervision Gain experience on board of a MASS ▪ Visits of MASS ▪ On board experience as far as possible Gain experience in response to malfunctions and emergencies ▪ Take part in emergency response exercises in the ROC Gain experience in port operations ▪ Visit port operations (cargo and mission operations, maintenance operations) ▪ Taking over of tasks under supervision				Hours: 480h The distribution of the hours to times in ROC, on board of a MASS, or in port depends on the possibilities of the operated MASS system.	
Language of teaching:		English			
Prerequisites:		Qualification according to STCW requirements for navigational officers or engineers or ETO's on operational level			
Teaching facility and equipment:		> In ROC which controls MASS systems remotely (as available) > On board of a MASS with crew on board (as applicable) > In port with operation of automated facilities			
Preparation/literature:		A task list for the practical training is to be prepared according to the possibilities of the ROC and MASS system			
Further information:		Module represents a basic training for navigators, engineers, and system administrators operating a MASS. Alternative simulator times are to consider in case a MASS system with an operating ROC is not available.			

Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
1.4.1.1. In-service training 1	Supervisor in ROC, in port, or on board of MASS	480h	Practical training	Report (R) (≈10,000 words or 20 p.), not graded

2. Modules “MASS ROC Operators Advanced Program”

2.1 MASS ROC Senior Operators – modules for all senior operators

2.1.1 MASS Operations 2

2.1.1. MASS Operations 2 (OPS 2)					
Total workload (h):	92h	Lectures (h):	40h	Simulator (h):	16h
Exercises (h):	16h	Examination (h)	4h	Self-Studies (h):	16h
Scope und frequency of teaching:	10 class lectures (4h) 2 days simulator training (8h) 4 classes exercises (4h)		All senior operators at management level (Navigators and Engineers)		
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... manage a MASS system (CL 5) ... manage documentation and analysing of voyage data of a MASS system (CL 4 - 5) ... optimise the MASS system (CL 4 - 5) <i>(regarding communication and cooperation)</i> ... decide on technical aspects of MASS systems ... take leadership and responsibility for a MASS system ... communicate technical aspects of MASS systems to other persons <i>(regarding reflection of professional identity)</i> ... contribute with technical management background to the operations of MASS					
Course content: Managing a MASS system - Standards of performance of a MASS system - Evaluation of performance, availability, reliability, resilience, data consistency - Continuous improvement Data analysis and documentation - Relevant data and parameters reflecting operational states of MASS systems - Data and information structuring, analysing, and improving - Software tools for data analysis - Derivation of settings, limitations, and alarms - Control of MASS performance based on data Optimisation of a MASS system - Evaluation of the specific systems of a MASS - Optimisation by using digital twins - Planning of optimisation measures (under operation and in port)					Hours: 16h 16h 8h
Exercise content: Module-related exercises (as examples and suggestion) - e.g. definition of a MASS performance indicators for specific use cases - e.g. analysing data for different degrees of automation - e.g. development of optimisation measures for different degrees of automation Simulator training - Familiarisation with workstations for direct control - Operating direct control - Analysing performance and data of sailed exercises					16h 16h
Language of teaching:		English			
Prerequisites:		Qualification according to STCW requirements for navigational officers or engineers on management level			

Teaching facility and equipment:	> For lectures: classroom with audio-visual presentation systems > For module-related exercises: workstations with access to digital twins for exemplary use cases > For simulator training: ROC-simulator with planning, monitoring, and direct control stations			
Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.			
Further information:	Module represents the advanced course for senior navigators and senior engineers operating a MASS.			
Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
1.1.1.5. MASS system management	Person competent in technical MASS management	40h	Seminar Style Lecture (SL)	Written Test (WT) (≈ 3h), or Module Paper (MP) (≈10,000 words or ≈20 p.), graded
1.1.1.6. Module related exercises	Person competent in technical MASS management	16h	Guided Exercises (MRE)	Practical Examination (PE), successful participation in exercises
1.1.1.7. Simulator training	Person competent in ROC operations	16h	Simulator Exercises (SIM)	Practical Examination (PE), successful participation in exercises

2.1.2 MASS Safety and Security 2

2.1.2. MASS Safety and Security 2 (SAS 2)					
Total workload (h):	70h	Lectures (h):	32h	Simulator (h):	16h
Exercises (h):	8h	Examination (h)	4h	Self Studies (h):	10h
Scope und frequency of teaching:		8 class lectures (4h) 2 days simulator training (8h) 2 classes exercises (4h)		All senior operators at management level (Navigators and Engineers)	
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... develop and maintain safety for the MASS and persons on board (CL 5) ... maintain security of the MASS, it's crew and passengers (CL 5) <i>(regarding communication and cooperation)</i> ... communicate efficiently in malfunction and emergency situations ... be the leader of a MASS emergency response team ... apply an efficient cooperation between MASS and ROC and other involved parties <i>(regarding reflection of professional identity)</i> ... take responsibility for the culture of safety and security of a MASS ... take the leadership in any emergency of a MASS system					
Course content: Emergency preparedness MASS and ROC - Establishing a safety culture in the entire MASS system - Developing and implementation of contingency plans for MASS - Maintaining availability of MASS specific and remote-controlled safety equipment Emergency response - Remote response on malfunctions and emergencies - Getting emergency-response teams on board of a MASS - Emergency organisation and procedures in ROC and on MASS - Getting MASS systems back to normal operations Security of a MASS - Development and implementation of security plans to MASS systems - Response on security-related situations - Assessment of cyber-risks and implementation of countermeasures					Hours: 12h 12h 8h
Exercise content: Module-related exercises (as examples and suggestion) - e.g. development of exemplary MASS-specific emergency procedures - e.g. response on malfunction or emergency response in different degrees of autonomy - e.g. development of a MASS-specific security measures Simulator training - Remote response and direct control in malfunction situations - Remote response and direct control in emergency situations - Procedural training for emergency response team - Procedural training in SAR operations					8h 16h
Language of teaching:		English			
Prerequisites:		Qualification according to STCW requirements for navigational officers or engineers on management level			
Teaching facility and equipment:		> For lectures: classroom with audio-visual presentation systems > For module-related exercises: safety and security documentation of exemplary MASS systems > For simulator training: ROC-simulator with emergency response stations			

Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.			
Teaching facility and equipment:	> For lectures: classroom with audio-visual presentation systems > For module-related exercises: documentation of exemplary MASS systems > For simulator training: ROC-simulator with emergency response stations			
Further information:	Module represents the advanced course for senior navigators and senior engineers operating a MASS.			
Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
2.1.2.1. MASS-System Safety 2	Person competent in ROC and MASS safety	24h	Seminar Style Lecture (SL)	Written Test (WT) (≈1.5h), or Module Paper (MP) (≈10,000 words or ≈20 p.), graded
2.1.2.2. MASS-System Security 2	Person competent in security and cyber risks	8h	Seminar Style Lecture (SL)	Written Test (WT) (≈1.5h), graded
2.1.2.3. Module related exercises	Person competent in ROC and MASS safety	8h	Guided Exercises (MRE)	Practical Examination (PE), successful participation in exercises
2.1.2.4. Simulator training	Person competent in ROC and MASS operations	16h	Simulator Exercises (SIM)	Practical Examination (PE), successful participation in exercises

2.1.3 MASS Management and Administration 2

2.1.3. MASS Management and Administration 2 (MMA 2)					
Total workload (h):	118h	Lectures (h):	68h	Simulator (h):	./h
Exercises (h):	16h	Examination (h)	2h	Self Studies (h):	32h
Scope und frequency of teaching:		17 class lectures (4h) 4 classes exercises (4h)		All senior operators at management level (Navigators and Engineers)	
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... Develop and improve the organisation of MASS systems (CL 5) ... Apply leadership and teamwork skills (CL 5) ... Implement management systems and improve the MASS system (CL 5) ... Apply risk management and appraise risks (CL 5) ... Monitor compliance with legislative requirements (CL 4) ... Consider economic aspects in operations of MASS systems (CL 5) <i>(regarding communication and cooperation)</i> ... Apply an efficient communication within MASS teams and with external parties ... Take leadership and responsibility of a MASS system <i>(regarding reflection of professional identity)</i> ... Take over responsibility as a MASS and ROC manager					
Course content: Organisation of a MASS system ▪ Structural organisation and allocation of responsibilities in an ROC and on a MASS ▪ Process management in ROC and on MASS ▪ Development, implementation and supervising of standard procedures Leadership and Teamwork in a MASS system ▪ Improving situational awareness of operators ▪ Teamwork in MASS systems in ROC and on MASS ▪ Structured decision-making in remote monitoring and control ▪ Workload distribution and stress reduction in remote monitoring and control MASS-related management systems ▪ Management systems implementation and application in a MASS system ▪ Determination of management objectives for a MASS system ▪ Setting-up of a continuous improvement of the MASS system ▪ Management and improvement of the quality and performance of a MASS system MASS-related risk management ▪ Performing operational risk assessments for a MASS system ▪ Management of risk mitigating measures in MASS systems Legislative framework for MASS systems ▪ International MASS legislation and regulation ▪ National MASS legislation and regulation ▪ Certification of MASS systems Economic aspects ▪ Evaluation of investments in automation systems ▪ Productivity and efficiency of MASS systems					Hours: 8h 16h 12h 8h 16h 8h
Exercise content: Module-related exercises (as examples and suggestion) ▪ e.g. developing of ROC organisations for different degrees of autonomy ▪ e.g. developing exemplary improvement measures for specific a management system ▪ e.g. analysing case studies on legal questions					16h

Language of teaching:	English			
Prerequisites:	Qualification according to STCW requirements for navigational officers or engineers on operational level			
Teaching facility and equipment:	> For lectures and module-related exercises: classroom with audio-visual presentation systems			
Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.			
Further information:	Module represents the advanced course for senior navigators and senior engineers operating a MASS.			
Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
2.1.3.1. MASS Resource Management	Person competent in human-related sciences	16h	Seminar Style Lecture (SL)	Oral Exam. (OE) (≈20 min), or Oral Present. (OP) (≈20 min) or Written Test (WT) (≈1 h), graded
2.1.3.2. MASS Management	Person competent in management systems	36h	Seminar Style Lecture (SL)	Written Test (WT) (≈1.5h), graded
2.1.3.3. MASS Legislation	Person competent in legislation	16h	Seminar Style Lecture (SL)	Written Test (WT) (≈1.5h), graded
2.1.3.4. Module related exercises	Person competent in MASS management	16h	Guided Exercises (MRE)	Practical Examination (PE), successful participation in exercises

2.2 MASS ROC Senior Navigators

2.2.1 MASS Navigation and Control

2.2.1. MASS Navigation and Control (NACO)

Total workload (h):	172h	Lectures (h):	88h	Simulator (h):	40h
Exercises (h):	16h	Examination (h)	4h	Self Studies (h):	24h
Scope und frequency of teaching:	22 class lectures (4h) 5 days simulator training (8h) 4 classes exercises (4h)			Senior navigators at management level	
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... Plan and track a MASS voyage (CL 5) ... Plan and approve a MASS passage (CL 5) ... Manoeuvre and handle a MASS in all conditions (CL 5) ... Monitor and conduct direct control a MASS (CL 5) ... Develop and improve human-machine-interfaces (HMI) (CL 5) ... Determine maintenance demands (CL 5) ... Manage remote inspections, maintenance and repair (CL 4 – 5) <i>(regarding communication and cooperation)</i> ... Communicate the navigational and operational status of the MASS ... Take over the direct control of a MASS in cooperation with other operational team members <i>(regarding reflection of professional identity)</i> ... Take over the responsibility for all MASS operations					
Course content: MASS navigation and manoeuvring - MASS voyage and passage planning - Specific requirements of a MASS in the ports and on the planned route - Setting passage parameters for the automation system - Using automated port facilities - MASS handling and manoeuvring (berthing, anchoring, pilotage, sea passage) in all conditions - Evaluation of navigational data and information for MASS MASS direct control - Operating a remote direct control based on sensor data - Control of the status of the MASS - Checking reliability of system data - Procedures to take-over control - Adjustment and changing of system parameters - Improvement of human-machine interfaces MASS Maintenance of navigational and communication equipment - Maintenance strategies for navigational and communication equipment - Remote analysis of system parameters and protocols, identification of root causes of failures - Spare part management - Remote management of maintenance and repair by persons on board - Integration of IT service providers					Hours: 32h 32h 24h
Exercise content: Module-related exercises (as examples and suggestion) - e.g. planning of manoeuvres in autonomous and direct control mode - e.g. procedural training in ROC and on MASS - e.g. developing maintenance strategies for automated navigation and communication equipment of a MASS and in ROC					16h 40h

Simulator training ▪ Remote handling of a MASS on pilotage and for anchoring and port manoeuvres ▪ Manoeuvring in different port situations and anchorages with challenging environmental conditions ▪ Procedures in ROC, on the MASS and between ROC and MASS (e.g. change over to direct control and back)				
Language of teaching:	English			
Prerequisites:	Qualification according to STCW requirements for navigational officers on management level			
Teaching facility and equipment:	> For lectures: classroom with audio-visual presentation systems > For module-related exercises: workstations with access to electronic navigation and communication systems > For simulator training: ROC-simulator with planning, monitoring and direct control stations			
Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.			
Further information:	Module represents the advanced course for senior navigators operating a MASS.			
Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
2.2.1.1. MASS Control	Person competent in MASS Navigation	64h	Seminar Style Lecture (SL), or Project (P)	Written Test (WT) (≈ 3h), or Project Report (PR) (≈10,000 words or ≈20 p.), graded
2.2.1.2. Operational Maintenance	Person competent in MASS maintenance	24h	Seminar Style Lecture (SL)	Written Test (WT) (≈ 1.5h), graded
2.2.1.3. Module related exercises	Person competent in MASS navigation	16h	Guided Exercises (MRE)	Practical Examination (PE), successful participation in exercises
2.2.1.4. Simulator training	Person competent in MASS navigation	40h	Simulator Exercises (SIM)	Practical Examination (PE), successful participation in exercises

2.2.2 MASS Cargo and Mission Operations 2

2.2.2. MASS Cargo and Mission Operations 2 (CMO 2)					
Total workload (h):	148h	Lectures (h):	80h	Simulator (h):	./.
Exercises (h):	32h	Examination (h)	4h	Self Studies (h):	32h
Scope und frequency of teaching:	20 class lectures (4h) 6 classes exercises (4h)		Senior navigators at management level		
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... Plan and ensure safe cargo and mission operations (CL 5) ... Operate a safe carriage of persons on board and passenger operations (CL 5) ... Control stability, trim, and strength of a MASS (CL 5) ... Manage defects and damages of MASS structure or deck equipment (CL 5) <i>(regarding communication and cooperation)</i> ... Communicate cargo and mission operations with all external parties and institutions ... Cooperate and coordinate all parties involved in cargo or mission operations <i>(regarding reflection of professional identity)</i> ... Take over the responsibility for all cargo and mission operations					
Course content: Cargo and mission operations of MASS ▪ Planning and control of automated cargo and mission operations ▪ Provisions of cargoes and their handling on MASS (e.g., container, break bulk, bulk, ro-ro cargo, refrigerated cargo, liquid cargo) ▪ Plan the loading of cargo for a MASS ▪ Remote control of cargo operations and cargo securing ▪ Remote-controlled cargo care at sea Carriage of persons and passengers on board of a MASS ▪ Procedures for boarding and disembarking of persons and passengers on MASS ▪ Remote control of passengers when underway ▪ Remote control of persons as service or riding crews when underway ▪ Behaviour of persons and passengers on MASS ▪ Communication lines between MASS and areas with persons on board ▪ On-board organisation and allocation of responsibilities concerning person’s control ▪ Use of person identification systems ▪ Handling of luggage and personal effects MASS seaworthiness ▪ Plan the stability conditions of a MASS ▪ Remote evaluation of stability, trim, and strength and the automatic control system ▪ Remote identification of hazards to the MASS, cargo and persons on board in the seaway ▪ Inspection for defects and damages at MASS structures and deck equipment ▪ Remote evaluation of structural damages of a MASS ▪ Remote corrective measures to maintain seaworthiness (e.g. specific manoeuvres)					Hours: 24h <

Language of teaching:	English			
Prerequisites:	Qualification according to STCW requirements for navigational officers on management level			
Teaching facility and equipment:	> For lectures: classroom with audio-visual presentation systems > For module-related exercises: workstations with access to exemplary use cases and a stability calculator for a MASS			
Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.			
Further information:	Module represents the advanced course for senior navigators operating a MASS.			
Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
2.2.2.1. Cargo and Mission Operations	Person competent in cargo and mission operations	48h	Seminar Style Lecture (SL), or Project (P)	Written Test (WT) (≈ 2h), or Project Report (PR) (≈7,000 words or ≈15 p.), graded
2.2.2.2. Passenger Operations	Person competent in passenger management	32h	Seminar Style Lecture (SL)	Oral Exam. (OE) (≈20 min), or Oral Present. (OP) (≈20 min) or Module Paper (MP) (≈7,000 words or ≈15 p.), graded
2.2.2.3. Module related exercises	Person competent in cargo and mission operations	32h	Guided Exercises (MRE)	Practical Examination (PE), successful participation in exercises

2.3 MASS ROC Senior Engineers

2.3.1 MASS Engineering Operations 2

2.3.1. MASS Engineering Operations 2 (ENG 2)					
Total workload (h):	164h	Lectures (h):	88h	Simulator (h):	./.
Exercises (h):	32h	Examination (h)	4h	Self Studies (h):	40h
Scope und frequency of teaching:		11 class lectures (8h) 8 classes exercises (4h)		Senior engineers at management level	
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... Manage automation and autonomy of MASS systems (CL 5) ... Manage propulsion and auxiliary MASS systems (CL 5) ... Determine maintenance demands (CL 5) ... Manage remote inspections, maintenance and repairs (CL 5) ... Establish integration of service providers (CL 4) <i>(regarding communication and cooperation)</i> ... Communicate the operational status of the MASS to all operators and related parties ... manage operational engineering in coordination with all team members <i>(regarding reflection of professional identity)</i> ... Take over the responsibility for management of the technical equipment of a MASS					
Course content: Management of MASS propulsion systems and its operation ▪ Electrical propulsion and energy storage systems on MASS ▪ Combustion engines with alternative fuels on MASS ▪ Fuel bunkering and storage systems ▪ Wind powered propulsion systems ▪ Optimisation of performance parameters and setting of limitations Management of MASS specific auxiliary systems and its operation ▪ Sensor systems ▪ Alternative power generation systems (wind, solar energy) ▪ Hotelling systems ▪ MASS deck equipment MASS and ROC automation systems and its operation ▪ Autonomous and automation modes in different degrees of autonomy ▪ Remote control system and management of performance ▪ Evaluation of reliability, availability, resilience of automated and autonomous systems Maintenance ▪ Demand planning by using different maintenance strategies ▪ Manage inspection and maintenance operations on a MASS ▪ Deriving and planning maintenance and repair on a MASS and in ROC ▪ Management of maintenance service crews at sea and in port ▪ Integration of service providers					Hours: 16h 16h 24h 32h
Exercise content: Module-related exercises (as examples and suggestion) ▪ e.g. analysing options for improvement and optimisation of autonomous and remote-controlled equipment ▪ e.g. development of procedures for ROC and MASS operations ▪ e.g. development of maintenance strategies for exemplary critical equipment ▪ e.g. procedural training on coordination of inspections and maintenance tasks					

Language of teaching:	English			
Prerequisites:	Qualification according to STCW requirements for engineers on management level			
Teaching facility and equipment:	> For lectures: classroom with audio-visual presentation systems > For module-related exercises: workstations with access to digital twins for exemplary use cases			
Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.			
Further information:	Module represents the advanced course for senior engineers operating a MASS.			
Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
2.3.1.1. Engineering Operations	Person competent in MASS technologies	32h	Seminar Style Lecture (SL), or Project (P)	Written Test (WT) (≈ 1.5h), or Project Report (PR) (≈7,000 words or ≈15 p.), graded
2.3.1.2. Automation Systems	Person competent in MASS automation	24h	Seminar Style Lecture (SL)	Written Test (WT) (≈ 1.5h), graded
2.3.1.3. Strategic and Operational Maintenance	Person competent in MASS maintenance	32h	Seminar Style Lecture (SL)	Written Test (WT) (≈ 1.5h), graded
2.3.1.4. Module related exercises	Person competent in MASS technologies	32h	Guided Exercises (MRE)	Practical Examination (PE), successful participation in exercises

2.3.2 MASS Operations Control

2.3.2. MASS Operations Control (MOM)					
Total workload (h):	156h	Lectures (h):	72h	Simulator (h):	40h
Exercises (h):	16h	Examination (h)	4h	Self Studies (h):	24h
Scope und frequency of teaching:	14 class lectures (4h) 5 days simulator training (8h) 8 classes exercises (4h)			Senior engineers at management level	
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... Plan a MASS passage (CL 5) ... Control and manage a MASS system (CL 5) ... Develop and improve human-machine-interfaces (HMI) (CL 5) <i>(regarding communication and cooperation)</i> ... Communicate the operational status of the MASS with team members and external parties ... Cooperate as a team leader in MASS operations <i>(regarding reflection of professional identity)</i> ... Take over the responsibility to control the operations of a MASS in all conditions					
Course content: Planning - Evaluation of the planned MASS passage - Determination and implementation of demands, consumptions, and limiting parameters for the MASS passage - Remote preparation of all operational systems for the passage Control of the MASS systems - Direct control of MASS operational systems - Evaluation of performance of all systems of the MASS system - Evaluation of data reliability and consistency - Procedures for direct control Human-Machine-Interface - Control of automation based on sensors - Use and improvement of HMI - Control of situational awareness of operators - Achieving of situational awareness in situations with required fast response					Hours: 16h 32h 24h
Exercise content: Module-related exercises (as examples and suggestion) - e.g. analysing case studies on different degrees of automation of MASS - e.g. developing parameters influencing situational awareness - e.g. analysing options for improvements of human-machine interfaces Simulator training - Direct control of MASS systems - Cooperation with navigators and other related parties - Management of deviations and alarms - Identification of deviations from limiting parameters and intervention procedures - Change over from monitoring to direct control and back					16h 40h
Language of teaching:		English			
Prerequisites:		Qualification according to STCW requirements for engineers on management level			

Teaching facility and equipment:	> For lectures: classroom with audio-visual presentation systems > For module-related exercises: workstations with access to digital twins for exemplary use cases > For simulator training: ROC-simulator with planning, monitoring and direct control stations			
Preparation/literature:	Lecture notes will be provided, participants will receive a reading list at the beginning of the course.			
Further information:	Module represents the advanced course for senior engineers operating a MASS.			
Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
2.3.2.1. MASS Operations Control	Person competent in ROC operations	40h	Seminar Style Lecture (SL), or Project (P)	Written Test (WT) (≈ 2h), or Project Report (PR) (≈7,000 words or ≈15 p.), graded
2.3.2.2. Human-Machine Interface	Person competent in human-machine interfaces	16h	Seminar Style Lecture (SL)	Oral Exam. (OE) (≈20 min), or Oral Present. (OP) (≈20 min) or Written Test (WT) (≈1 h), graded
2.3.2.3. Module related exercises	Person competent in MASS operation control	32h	Guided Exercises (MRE)	Successful participation in exercises
2.3.2.4. Simulator training	Person competent in MASS operation control	40h	Simulator Exercises (SIM)	Practical Examination (PE), successful participation in exercises

2.4 MASS ROC Senior Operators – In-Service Training

2.4.1 MASS In-Service Training 2

2.4.1. MASS In-Service Training 2 (IST 2)					
Total workload (h):	320h	Lectures (h):	./.	Simulator (h):	./.
Exercises (h):	240h	Examination (h)	./.	Self Studies (h):	80h
Scope und frequency of teaching:		8 weeks (40 days)		All operators at management level: ▪ Navigators, ▪ Engineers.	
Learning outcomes: Upon successful completion of this module, participants are expected to be able to ... <i>(regarding using, applying, and generating knowledge (applying and transferring knowledge))</i> ... evaluate the operation of a MASS system (CL 5) ... evaluate the performance of autonomous and automated systems of a MASS system (CL 5) ... organise procedures in an ROC and on a MASS (CL 4 - 5) ... operate a MASS in direct control (CL 5) ... operate a MASS system safe and efficient (CL 5) ... identify critical situations for a MASS and to intervene accordingly (CL 5) <i>(regarding communication and cooperation)</i> ... be convinced to take leadership of teams controlling a MASS ... cooperate as a team leader with all team members and other parties involved in MASS operations <i>(regarding reflection of professional identity)</i> ... take over responsibility for a MASS with or without crew and persons on board					
Course content: Gain experience in ROC ▪ Taking over of tasks in an ROC under supervision ▪ Take remote direct control of a MASS under supervision Gain experience on board of a MASS ▪ Visits of MASS ▪ On board experience as far as possible Gain experience in response to malfunctions and emergencies ▪ Take over the lead in emergency response exercises in the ROC Gain experience in port operations ▪ Visit port operations ▪ Taking over planning and operational tasks under supervision				Hours: 240h The distribution of the hours to times in ROC, on board of a MASS, or in port depends on the possibilities of the operated MASS system.	
Language of teaching:		English			
Prerequisites:		Qualification according to STCW requirements for navigational officers or engineers on management level			
Teaching facility and equipment:		> In ROC which controls MASS systems remotely (as available) > On board of a MASS with crew on board (as applicable) > In port with operation of automated facilities			
Preparation/literature:		A task list for the practical training is to prepare according to the possibilities of the ROC and MASS system			
Further information:		Module represents the advanced training for senior navigators and senior engineers operating a MASS. Alternative simulator times are to consider in the case that a MASS system with an operating ROC is not available.			

Courses of the module				
Course title	Teaching staff	Contact hours	Learning and teaching methods	Examination method(s), scope and duration
2.4.1.1. In-service training 2	Supervisor in ROC, in port, or on board of MASS	240h	Practical training	Report 10,000 – 15,000 words (or 20 – 25 pages); not graded

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