European Maritime Safety Agency

CMOROC Appendix F - Module Catalogue

Identification of Competences for MASS Operators in Remote Operation Centres

V 2.3

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EMSA

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Table of Contents

List of Tables

List of Figures

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

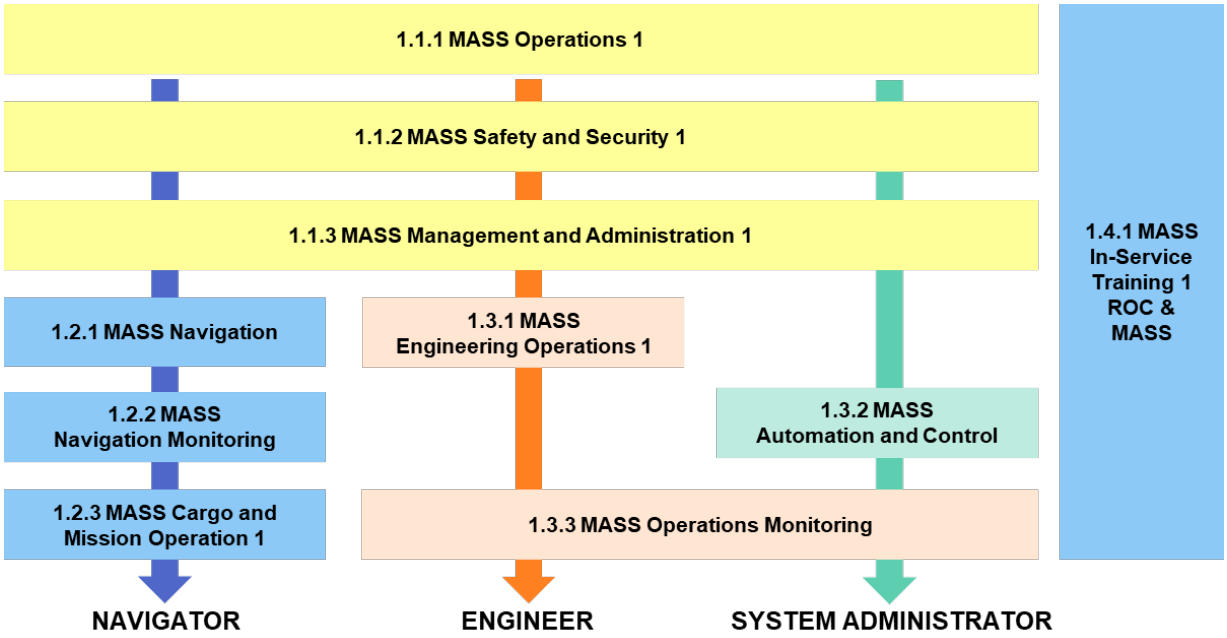

Figure 1: Arrangement of Modules "MASS ROC Operator Basic Program"

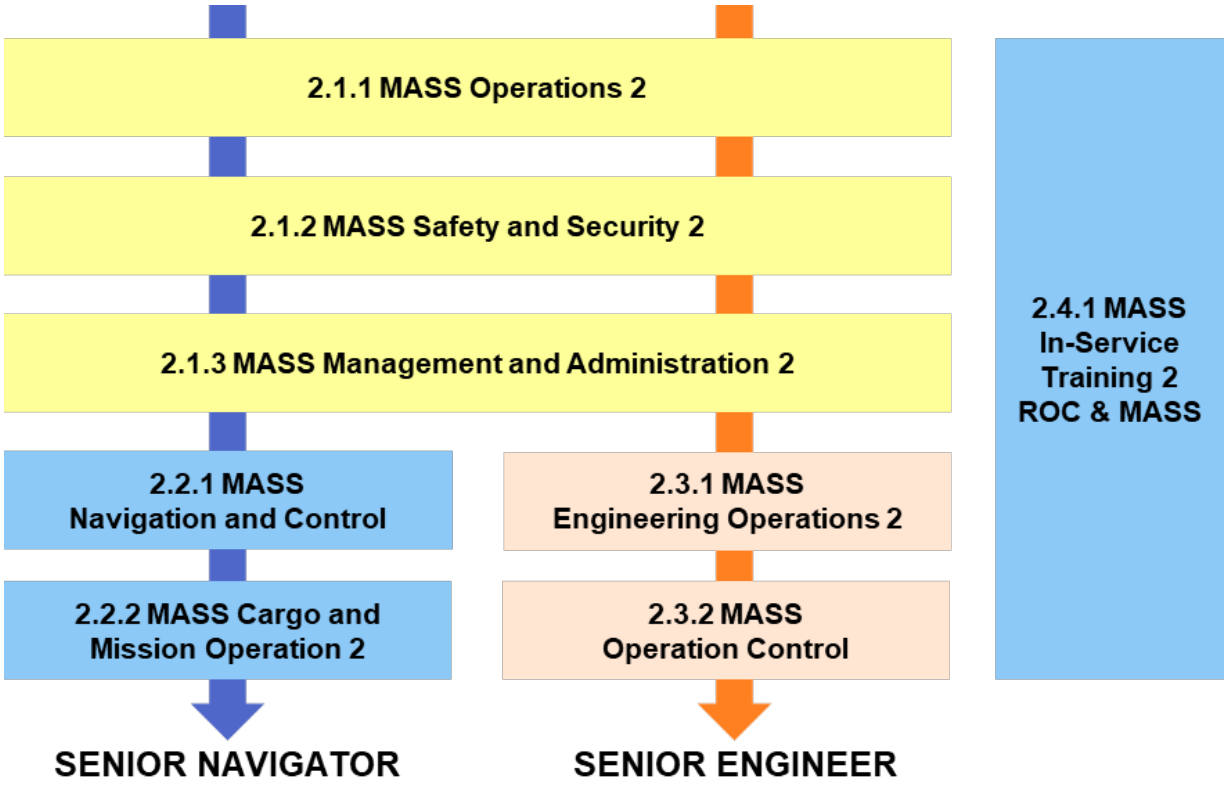

Figure 2: Arrangement of Modules "MASS ROC Operator Advanced Program"

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 …

(regarding knowledge and understanding (extension, consolidation, and understanding of knowledge))

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

… 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)

(regarding communication and cooperation)

… communicate technical and operational aspects of MASS systems
… share aspects of MASS systems with other persons

(regarding reflection of professional identity)

… contribute with consolidated technical and operational background to the operations of MASS

Consider MASS competence tables for details.

Course content (lecture):	Hours:
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	16h
Levels of automation and autonomy ▪ Field level, control level, supervisory level ▪ Hardware and automation systems ▪ Interfaces and protocols	16h
Communication and digital networks ▪ Design and use of satellite and terrestrial networks ▪ Use of digital platforms ▪ Availability and reliability of networks	12h
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	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 Simulator training ▪ Familiarisation with workstations for planning, monitoring, and controlling ▪ Familiarisation with automated systems ▪ Familiarisation with data management	12h 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 …

(regarding knowledge and understanding (extension, consolidation, and understanding of knowledge))
(regarding using, applying, and generating knowledge (applying and transferring knowledge))

… 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)

(regarding communication and cooperation)

… Apply an efficient communication within MASS teams
… Contribute to safe, secure and efficient operations as a part of a MASS team

(regarding reflection of professional identity)

… Take over responsibility as a MASS operator for an efficient and reliable MASS system

Consider MASS competence tables for details.

Course content (lecture):	**Hours:**
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	12h
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	12h
MASS-related risk management ▪ Operational risks of a MASS system ▪ Mitigating risks in MASS systems	8h
Legislative framework for MASS systems ▪ International MASS legislation and regulation ▪ National MASS legislation and regulation	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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

… 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)

(regarding communication and cooperation)

… 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

(regarding reflection of professional identity)

… Take over responsibilities to navigate a fleet of MASS

Consider MASS competence tables for details.

Course content (lecture):	**Hours:**
Operation of MASS navigation and communication systems ▪ Automation and control systems ▪ Navigation systems ▪ Sensor systems ▪ Communication systems ▪ Integration of all systems	24h
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	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	16h
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	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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

- … 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)

(regarding communication and cooperation)

- … 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

(regarding reflection of professional identity)

- … Take over the role of a monitoring operator and take the responsibilities

Consider MASS competence tables for details.

Course content (lecture):	**Hours:**
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	36h
MASS Maintenance of navigational and communication equipment ▪ Remote system updates ▪ Analysis of alarms and malfunctions ▪ Remote maintenance procedures	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	8h
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

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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

- … 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)

(regarding communication and cooperation)

- … Communicate cargo and mission operations with external parties and institutions
- … Cooperate as part of the MASS team with all team members

(regarding reflection of professional identity)

- … Take over the responsibility for monitoring of cargo and mission operations

Consider MASS competence tables for details.

Course content:	**Hours:**
Cargo and mission operations of MASS	20h
▪ 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	20h
▪ 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	

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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

- … 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)

(regarding communication and cooperation)

- … Take part in the communication of the operational status of the MASS
- … Cooperate as a team member for operational engineering

(regarding reflection of professional identity)

- … Take over the responsibility for operating the technical equipment of a MASS

Consider MASS competence tables for details.

Course content (lecture):	**Hours:**
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	20h
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	12h
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	16h
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	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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

- … 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)

(regarding communication and cooperation)

- … Take part in the communication of the operational status of the MASS
- … Cooperate as a team member for MASS automation, control and data management

(regarding reflection of professional identity)

- … Take over the responsibility for operating the automation and control systems of a MASS

Consider MASS competence tables for details.

Course content (lecture):	**Hours:**
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	20h
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	20h 8h
MASS data analysis ▪ Data structuring and analysis ▪ Derivation of baselines for limitations and alarms ▪ Evaluation of consistency and reliability of MASS data	16h
Integration of service providers ▪ Operational platforms for information processing ▪ Interoperation with service providers	16h
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	

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 Simulator training ▪ Exercises on control of performance for exemplary MASS systems with different systems	24h 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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

- … 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)

(regarding communication and cooperation)

- … Communicate the operational status of the MASS with team members and external parties
- … Cooperate as a team member in MASS monitoring

(regarding reflection of professional identity)

- … Take over the responsibility to monitor the operational status of a MASS

Consider MASS competence tables for details.

Course content (lecture):	**Hours:**
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	40h
Human-Machine-Interface ▪ Workstation design ▪ Sensor systems and reliability of data ▪ Monitoring a fleet of MASS ▪ Information presentation and human perception ▪ Maintaining situational awareness	16h
Communication with other stations ▪ Communication systems between ROC and MASS ▪ Communication systems with other stations ▪ Monitoring data communication	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	24h
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	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):**	./.	**Simulator (h):**	./.
Exercises (h):	480h	Examination (h)	./.	**Self Studies (h):**	120h
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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

- … 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)

(regarding communication and cooperation)

- … Be convinced to work in teams to control a MASS
- … Cooperate as a team member for MASS operations

(regarding reflection of professional identity)

- … Take over responsibility on tasks to control a MASS

Course content:	**Hours:**
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	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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

- … 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)

(regarding communication and cooperation)

- … decide on technical aspects of MASS systems
- … take leadership and responsibility for a MASS system
- … communicate technical aspects of MASS systems to other persons

(regarding reflection of professional identity)

- … contribute with technical management background to the operations of MASS

Course content:	Hours:
Managing a MASS system	16h
▪ Standards of performance of a MASS system ▪ Evaluation of performance, availability, reliability, resilience, data consistency ▪ Continuous improvement	
Data analysis and documentation	16h
▪ 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	8h
▪ Evaluation of the specific systems of a MASS ▪ Optimisation by using digital twins ▪ Planning of optimisation measures (under operation and in port)	

Exercise content:	
Module-related exercises (as examples and suggestion)	16h
▪ 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	16h
▪ Familiarisation with workstations for direct control ▪ Operating direct control ▪ Analysing performance and data of sailed exercises	

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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

- … 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)

(regarding communication and cooperation)

- … 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

(regarding reflection of professional identity)

- … take responsibility for the culture of safety and security of a MASS
- … take the leadership in any emergency of a MASS system

Course content:	**Hours:**
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	12h
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	12h
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	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	8h
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	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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

… 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)

(regarding communication and cooperation)

… Apply an efficient communication within MASS teams and with external parties
… Take leadership and responsibility of a MASS system

(regarding reflection of professional identity)

… Take over responsibility as a MASS and ROC manager

Course content:	**Hours:**
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	8h
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	16h
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	12h
MASS-related risk management ▪ Performing operational risk assessments for a MASS system ▪ Management of risk mitigating measures in MASS systems	8h
Legislative framework for MASS systems ▪ International MASS legislation and regulation ▪ National MASS legislation and regulation ▪ Certification of MASS systems	16h
Economic aspects ▪ Evaluation of investments in automation systems ▪ Productivity and efficiency of MASS systems	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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

… 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)

(regarding communication and cooperation)

… Communicate the navigational and operational status of the MASS
… Take over the direct control of a MASS in cooperation with other operational team members

(regarding reflection of professional identity)

… Take over the responsibility for all MASS operations

Course content:	**Hours:**
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	32h
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	32h
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	24h
Exercise content:	**Hours:**
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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

… 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)

(regarding communication and cooperation)

… Communicate cargo and mission operations with all external parties and institutions
… Cooperate and coordinate all parties involved in cargo or mission operations

(regarding reflection of professional identity)

… Take over the responsibility for all cargo and mission operations

Course content:	**Hours:**
Cargo and mission operations of MASS	24h
▪ 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	32h
▪ 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	24h
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)	

Exercise content:

Module-related exercises (as examples and suggestion)

- e.g. case studies on planning of cargo loading for different types and degrees of automation of MASS
- e.g. case studies on control of crew and passengers on board
- e.g. exercises on remote-controlled stability systems of MASS

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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

- … 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)

(regarding communication and cooperation)

- … Communicate the operational status of the MASS to all operators and related parties
- … manage operational engineering in coordination with all team members

(regarding reflection of professional identity)

- … Take over the responsibility for management of the technical equipment of a MASS

Course content:	**Hours:**
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	16h
Management of MASS specific auxiliary systems and its operation ▪ Sensor systems ▪ Alternative power generation systems (wind, solar energy) ▪ Hotelling systems ▪ MASS deck equipment	16h
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	24h
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	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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

… Plan a MASS passage (CL 5)
… Control and manage a MASS system (CL 5)
… Develop and improve human-machine-interfaces (HMI) (CL 5)

(regarding communication and cooperation)

… Communicate the operational status of the MASS with team members and external parties
… Cooperate as a team leader in MASS operations

(regarding reflection of professional identity)

… Take over the responsibility to control the operations of a MASS in all conditions

Course content:	**Hours:**
Planning	16h
▪ 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	32h
▪ 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	24h
▪ 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	

Exercise content:	
Module-related exercises (as examples and suggestion)	16h
▪ 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	40h
▪ 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	

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 …

(regarding using, applying, and generating knowledge (applying and transferring knowledge))

… 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)

(regarding communication and cooperation)

… 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

(regarding reflection of professional identity)

… take over responsibility for a MASS with or without crew and persons on board

Course content:	**Hours:**
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	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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