COC COURSES TO REVALIDATE COMPETENCES BY USING SIMULATORS

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ABSTRACT

This paper presents main results of the International Association Maritime Universities (IAMU) Project titled "COC course to revalidate competences by using simulators". Use of simulation is considered relevant for maritime education and training, in accordance with Part A, Chapter I, Section I/11 of the STCW Code. Every master, officer and radio operator holding a certificate issued or recognized under any chapter of the Convention other than chapter VI, who is serving at sea or intends to return to sea after a period ashore, shall, in order to continue to qualify for seagoing service, be required, at intervals not exceeding five years, to establish continued professional competence. So the revalidation of certificates (if required) for continued professional competence shall be established, among others, successfully completing an approved training course or courses. The main objective of this contribution is to propose four complete revalidation courses (deck and marine engineer disciplines) using simulation technology to assessment, examination and certification of seafarers' competence in accordance with the provisions of STCW Code for existing marines who need upgrade their professional maritime certificates.

KEY WORDS

Maritime Education and Training (MET), Simulation, STCW Code, Revalidation of certificates

1. INTRODUCTION

International Maritime Organization's (IMO) international convention on Standards of Training, Certification and Watch-keeping for seafarers (STCW) was ratified by all maritime nations. Today, IMO has advised/encouraged all contracting governments/interested parties to review and, as necessary, to revise their crew academic/vocational competency described in STCW. Furthermore, the European Maritime Safety Agency (EMSA) started a regular assessment process providing quality improvement in the Maritime Education and Training (MET) institutions throughout European Union members, candidate countries and others.
In accordance with Part A, Chapter I, Section I/11, every master, officer and radio operator holding a certificate issued or recognized under any chapter of the Convention other than chapter VI, who is serving at sea or intends to return to sea after a period ashore, shall be required to demonstrate continued professional competence in order to keep his/her qualification for seagoing service. This requirement shall not exceed a 5 years interval. This last also in accordance with the standards

governing the use of simulators, Reg I/12 of STCW Code.

This paper proposes four complete revalidation courses (deck and marine engineer disciplines) using simulation technology to obtain a well-defined project and reach a common academic program to demonstrate all competences to license the revalidation certification by using simulation.

2. INVENTORY OF THE COMPETENCES

In accordance with the spirit of STCW which promotes the use of simulators in MET since 1995 and considering that nowadays the competences of seafarers are usually demonstrated only in oral or written exams, this section will make the inventory of the STCW competences that can be demonstrated by approved simulator training, according to STCW 95/2010 Code Part A competences tables. These competences will no longer require theoretical, written or oral examinations, but can be practically demonstrated by means of simulation. The legal basis for evaluating only with simulator is found in column 3 of the tables provided, where it says for all these cases: Column 3. Methods for demonstrating competences: Assessment of evidence obtained from one or more of the following: (...) *in all cases, one of the modalities is: approved simulator training, where appropriate.*

From Deck competences, there are a total of 39 competences described in column 1 of tables AII/1 and AII/2 of STCW, and 26 may be evaluated using a simulator, that is the 66.7%. There are a total of 19 competences for the operational level, and 11 of them can be evaluated using a simulator (57.9%); there are a total of 20 competences for the management level, and 15 of them may be evaluated using a simulator (75%).

Table 1 and 2 show each of these competences and the type of simulator to be used to evaluate the competence and, if it is necessary, the Support Material (SM) for operational and management levels.

Table 1. Bridge simulators and SM required for deck competences from (1) to (11). NAV: Navigation equipment trainer; COM: Communication procedures/GMDSS equipment trainer; NAV/RAD: radar and navigation simulator; CRA: crane handling simulator; VTS: vessel traffic management simulator; SAR: search and rescue management trainer; CAR: cargo handling trainer; BAL: ballast control trainer.

Competence (1) Plan and conduct a passage and determine position	With NAV or NAV/RAD with ECDIS application & SM
Competence (2) Maintain a safe navigational watch	With NAV/RAD, COM, and VTS. SM
Competence (3) Use of radar and ARPA to maintain the safety of navigation	With NAV or NAV/RAD with ARPA application & SM
Competence (4) Use of ECDIS to maintain the safety of navigation	With NAV or NAV/RAD with ECDIS application & SM
Competence (5) Respond to emergencies	With SPI, CAR and/or BAL, and SAR & SM
Competence (6) Respond a distress signal at sea	With SAR and COM
Competence (7) Transmit and receive information by visual signaling	With SM, COM and SAR
Competence (8) Ship maneuvering and handling	With NAV & SM
Competence (9) Monitor the loading, stowage, securing, care during the voyage and the unloading of cargoes	With CAR, CRA and COM & SM
Competence (10) Inspect and report defects and damage cargo spaces, hatch covers and ballast tanks	It depends on the simulator; a priori, with SM during the briefing. A theoretical test or exam is more preferable
Competence (11) Maintain seaworthiness of the ship	With CAR, BAL & SM

And for deck competences at management level:

Table 2. Bridge simulators and SM required for deck competences from (12) to (26).

Competence (12) Plan a voyage and conduct navigation	With NAV with ECDIS application, VTS & SM
Competence (13) Determine position and the accuracy of resultant position fix by any means	With NAV with ECDIS application & SM
Competence (14) Determine and allow for compass errors	With NAV & SM
Competence (15) Coordinate search and rescue operations	With NAV, SAR, COM & SM
Competence (16) Establish watch keeping arrangements and procedures	With NAV & SM
Competence (17) Maintain safe navigation through the use of information from navigation equipment and systems to assist in command decision making	With NAV/RAD with ARPA application, COM & SM
Competence (18) Maintain the safety of navigation through the use of ECDIS and associated navigations system to assist in command decision making	With NAV/RAD with ECDIS application & SM
Competence (19) Manoeuver and handle a ship in all conditions	With NAV, COM and SHIP, BAL, VTS & SM
Competence (20) Operate remote controls of propulsion plant and engineering systems and services	With SHIP, CAR, BAL & SM

Competence (21) Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes	With SHIP, CAR, BAL, COM & SM
Competence (22) Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action	With SM and a simulation depending on the simulator
Competence (23) Carriage of dangerous goods	With SM. It depends on the simulator
Competence (24) Control trim, stability and stress	With CAR, BAL & SM
Competence (25) Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and the protection of the marine environment	This competence consist of a wide knowledge of legislative requirements which can be explained an devaluated with SM.
Competence (26) Use of leadership and managerial skill	With any simulator, a specific circumstance may be simulated

From Marine Engineering competences, there are a total of 31 competences described in column 1 of tables AIII/1 and AIII/2 of the STCW. Of them 16 may be evaluated using simulator that is 51.6%. There are a total of 17 competences for the operational level, and 6 of them may be evaluated by simulator: that is the 35.5%; there are a total of 14 competences for the management level and 10 of them may be assessed by simulator; that is 71.4%.

As can be seen, management competencies are those that can mainly be evaluated through the simulator.

Table 3 and 4 show a resume a lists with the specific knowledge areas for each competence and the use of Engine Room Simulator (ERS).

Table 3. ERS and SM required for competences from (1) to (6).

Competence (1) Maintain a safe engineering watch	With ERS
Competence (2) Use internal communication systems	With ERS
Competence (3) Operate main and auxiliary machinery and associated control systems	With ERS
Competence (4) Operate fuel, lubrication, ballast and other pumping systems and associated control systems	With ERS &a) Operational characteristics of pumps and piping systems, including control systems. With ERS; some SM may be used during briefing (dismantling schemes, power point presentations or video tutorials)
Competence (5) Operate electrical, electronic and control systems	With ERS & Control system: Various automatic control methodologies and characteristics. With SM during briefing. Proportional-Integral-Derivative (PID) control characteristics and associated systems devices for process control. It depends on the simulator.
Competence (6) Maintain seaworthiness of the ship	With ERS & Ship stability. With SM during briefing and debriefing understanding that comprehension must be demonstrated by simulated action. Ship construction. With SM during briefing such as structural ship design programs.

And for engine competences at management level:

Table 4. ERS and SM required for competences from (7) to (16).

Competence (7) Manage the operation of propulsion plant machinery	With ERS
Competence (8) Plan and schedule operations	With ERS & Physical and chemical properties of fuels and lubricants. With SM during briefing. Technology of materials. Depending on the simulator. c) Naval architecture and ship construction, including damage control. With SM during briefing such as structural ship design programs
Competence (9) Operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery	With ERS
Competence (10) Manage fuel, lubrication and ballast operations	With ERS
Competence (11) Manage operation of electrical and electronic control equipment	With ERS
Competence (12) Manage trouble-shooting, restoration of electrical and electronic control equipment to operating condition	With ERS
Competence (13) Detect and identify the cost of machinery malfunctions and correct faults	With ERS
Competence (14) Control trim, stability and stress	With ERS &With the SM during briefing and debriefing, understanding that comprehension must be demonstrated by simulated action
Competence (15) Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and protection of the marine environment	This competence consists of a wide knowledge of legislative requirement, which can be explained and evaluated with the SM during the briefing. Nevertheless, some skills may be simulated, like for example, discharging oily water using a virtual flow-meter according to MARPOL.
Competence (16) Use leadership and managerial	With ERS

If a knowledge aspect is assessable by using additional material apart from the simulator, rather than mentioning the type of simulator, this is indicated as Supporting Material (SM). In case of a specific knowledge that today cannot commonly be assessed by simulator or SM, it is indicated by "it depends on the simulator".

3. SCHEME OF THE EXERCISES FOR THE MODERN COC COURSE

It is observed that many skills/knowledge areas may be explained and evaluated in a single

exercise. For instance, the use of navigational equipment, such as radar, ARPA, steering control systems or ECDIS, can be assessed at the same time that the deck watch keeping procedures. On the other hand, the use of engine room equipment such as main engines, diesel or turbo generators, boilers or bilge water system can be assessed at the same time that the engine room watch keeping procedures.
Therefore, for each level and discipline, it is possible to do some long exercises (7 for deck and 7 for engineers) for training; simulating (Table 5 and 6).

Table 5. Operational and management deck competences assessed in each standard exercise.

Exercise	Competences at Operational level	Competences at Management level
1.Familiarization		
2.Planning a voyage	(1) (2)	(12) (18)
3.Watchkeeping	(1) (2) (3) (4)	(13) (14) (16) (17)
4.Maneuvering	(8)	(19) (20)
5.Cargo handling	(9) (10)	(21) (22) (23)
6.Emergencies and rescue	(5) (6) (7)	(15)
7.Controlling the operations	(11)	(24) (25) (26)

Table 6. Operational and management engineer's competences assessed in each standard exercise.

Exercise	Competences at Operational level	Competences at Management level
1. Familiarization		
2. Starting and stopping engine room machinery	(3) (4)	(8)
3. Engine room Watch keeping	(1) (3)	(7) (8)
4. Preparing Engine Room for the port arrival and port departure	(2) (3)	(7) (8)
5. Troubleshooting	(3)	(12) (13)
6. Electrical, electronic and control	(5)	(8) (11)
7. Controlling & managing the operations of the ship and care on board	(4) (6)	(8) (9) (10) (14) (15) (16)

4. DESIGN THE MODERN COC COURSE STRUCTURE

Including all competences assessed with a simulator mentioned in the above section, four modern revalidation courses have been designed: two for deck officers (operational and management level) and two for engine room officers (operational and management level).
Each course has been designed following the main parts of IMO model courses:

Part A. Course framework: those who successfully complete this course should be able to demonstrate sufficient knowledge, skill and understanding of the competences (that can be evaluated using a simulator).

Part B. Course outline and timetable: this section presents the topics of the 43-h course in a simplified outline format allocated in the following manner (see Table 7).

Table 7. Distribution of the total number of hours of the revalidation courses.

	Familiarization with simulators	Briefings, debriefings & no-simulation explanations	Simulation trainings	Evaluation in simulators	Evaluation theoretical exam
Operational (Deck)	2.0	16.0	22.0	2.0	1.0
Management (Deck)	2.0	19.5	18.5	2.0	1.0
Operational (Engine)	2.0	9.0	29	3.0	0.0
Management (Engine)	2.0	8.0	30	3.0	0.0

All topics are organized into seven general subject areas or exercises.
A 7-day course is considered to be sufficient to evaluate all competences using different simulation scenarios, taking into account that students only have to refresh a knowledge they have previously acquired. Generally, each simulation training has duration of 2 hours being the first half hour as briefing and the last half hour as debriefing, with 1 hour of simulation in between.
The timetable has been thought for doing two sessions in the mornings and one session in the afternoons during 7 days. Between both morning sessions, a break of 0.5 h is recommended.

Otherwise, a more intensive course may be done with two sessions in the morning and two more in the afternoons for 5 days, adding a sixth morning for revaluation the trainees. In both cases, the course consists of 20 sessions of 2 h and 1 exam of 3 h. Appendix 1 shows an example of a course timetable for deck operational level.

Part C. Detailed teaching syllabus: the material listed in the course framework has been used to structure the detailed teaching syllabus, in particular:

- Teaching aids (indicated by A),
- Bibliography (indicated by B),
- IMO references (indicated by R)
- Textbooks (indicated by T)

Table 8 includes the knowledge of one topic, as an example, and the teaching aids and references that are used for the specific level.

Table 8. Example of detailed teaching syllabus for one topic (operational level - deck). Teaching Aids (A), IMO References (4) and Textbooks (T) are described in the Reference section.

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
7. Controlling the operations (3.0 h)		
7.1. Ship stability (2.0 h) – Topic 36	A1 A2 A4	R1 R2 R4 R5 R30 R42 R43 A/B R44 R45 R46 R47 R48 R49 R50 R51 R52 T26 T27 T28 T33 T34
7.1.1. Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment		
7.1.2. Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy		
7.1.3. Understanding of the fundamentals of watertight integrity		
7.2. Ship construction (1.0 h) – Topic 37	A1 A2 A4	
General knowledge of the principal structural members of a ship and the proper names for the various parts.		

Part D. Evaluation and assessment.

Part E. Instructor manual. The instructor manual section defines the scenario for each of the tasks, taking into account that each exercise has different parts contents and objectives. An example scenario considering "Part E. Instructor manual" section is described as follows:

Title: Simulator Familiarization Vessel
Model: Tanker LCC Exercise
nr: ERS 3
Duration: - Briefing: 30 minutes.
- Simulator run: 60 minutes.
- Debriefing: 30 minutes.

Objectives: This exercise familiarizes the student with: Steam plant, Familiarization on starting up auxiliary boiler and Boilers' fuel system.

Prerequisites: Basic theoretical steam generators knowledge.

Training materials:
- Engine Room Simulator ERS 5000 (including all auxiliary systems).
- Overhead sheets and/or PowerPoint presentation.

Initial condition simulator: ME stopped, DG1 working and connected to the net, DG2 on stand-by HFO and DO service tanks at right level. The boiler is empty, off pressure and cold.

Briefing:
- Getting acquainted with students.
- Introduction of engine room exercises during this session.
- Explanation of an engine room exercise (briefing, training, debriefing).
- Pointing out and explanation of mnemonic diagrams.

Student action:
- During briefing: Attend lecture and explanation of the use of simulators.
- During exercise: Get familiar with and try out different actions to be taken with Simulator.

Instructor action:
- Before starting the simulation, explain simulator mnemonic diagrams.

- Before handing over the Watch point out the main engine and auxiliaries situation.
- Monitor and observe students and ascertain if objectives are met.

Debriefing:
- Reiterate objectives and check if they are met.
- Point out positive actions
- Start a discussion by means of peer review.
- Summarize students' actions and conclusions.
- Discuss points for improvement.

Evaluation: Check if students are capable (all objectives met) of using the Engine Room equipment properly in coming exercises.

Exercise resolution step by step:
1) Steam boiler start up with Diesel and rising pressure.
- Aux-BFS: Select Diesel oil as feeding fuel.
- Check tank levels and make up if needed.
- Check all valves are open.
- Start up fuel pumps (6 bar working pressure).
- Open valves to burners.
- Aux-SP: open deaerating valve.
- Check boiler water level and make up if needed.
- Open super heater valve.
- Start up fan and burners.
- Set the Auto mode and select 15bar maximum pressure.
- Start up feeding pump and set control to Auto.
- Once boiler pressure rises to 1,5 bar, close deaerating valve and open cooling water valve to condenser.
- Once boiler pressure rises up to 12 bar, open the Main Steam Valve to feed the steam consumers.
- Open valves to Deck, Cabins, Separators, FO tank, HFO tank, TG when needed.
2) Boiler feeding fuel change: from Diesel Oil to Fuel Oil
- Once the pressure in the boiler is higher than 12 bar and the fuel tank is at right temperature (90ºC), we can change to fuel.
- Aux-SP: stop burners.
- Aux-BFS: stop pumps (on manual mode).
- Select Fuel Oil.
- Open preheating steam valve setting the output to 120ºC.
- Start up pumps again and set Auto mode.
- Aux-SP: start up the burners again.

3. CONCLUSIONS

A simulator is a tool used in a learning process so the requirement to measure its effectiveness on the attainment of a learning objective is as valid as with any other tools. The development of four simulation COC courses will provide the required education level and will homogenize the approaches for different counties concerning revalidation programs in accordance with the provisions of the STCW Code for existing seafarers who need to upgrade their professional maritime knowledge. These courses will also provide training using simulation material.

Moreover, these courses will offer a guide for schools and maritime authorities with a modern way to examine the revalidation of the expired COCs and provide maritime industry revalidated and newly educated seafarers.

However, these courses require a complementary structure for other competences that cannot be assessed by simulation. This should be developed in further work. Another important point is that the course is only applicable for the revalidation purpose previous Maritime Administration recognizes and approves the method in the revalidation process according to their prevailing procedures.

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REFERENCES

1. R1 Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW Convention), as amended, 2011 Edition, IMO
2. R2 International Convention for the Safety of Life at Sea, 1974, as amended (SOLAS), Consolidated Edition 2009, IMO
3. R4 Model Course 7.03 – Officer in Charge of a Navigational Watch, 1999 Edition, IMO

4. R5 Model Course 1.22: Ship Simulator and Bridge Teamwork, 2002 Edition, IMO
5. R30 International Convention for the Prevention of Pollution from Ships, 1973/78 (MARPOL), Consolidated edition 2011, IMO.
6. R42 International Conference on Load Lines, 1966, 2005 Edition, IMO
7. R43A Assembly Resolution A.760(18) - Symbols related to life-saving appliances and arrangements. Amended by MSC.82(70)
8. R43B Resolution MSC.82(70), Amendments to resolution A.760(18) on symbols related to life-saving appliances and arrangements, 1998
9. R44 Assembly Resolution A.921(22) - Assembly resolutions superseded by the 1995 amendments to the 1978 STCW Convention
10. R45 International Conference on Special Trade Passenger Ships Agreement, 1971, 1972 Edition, IMO
11. R46 Protocol on Space Requirements for Special Trade Passenger Ships, 1973, (SPACE STP 1973), IMO
12. R47Athens convention relating to the Carriage of Passengers and their Luggage by Sea, 1974 (PAL 1974), IMO
13. R48 International Convention on Tonnage Measurement of Ships, 1969, IMO
14. R49 Assembly Resolution A.769(18) – Procedures and Arrangements for Issuing GMDSS Certificates to Holders of Non-GMDSS Certificates
15. R50 IMO/ILO Document for Guidance, 1985, IMO
16. R51 International Safety Management Code (ISM Code) and Guidelines on implementation of the ISM Code, 2010 Edition, IMO
17. R52 International Life-Saving Appliance (LSA Code), 2010 Edition, IMO
18. T26 Derret, D.R.; Barrass, B. Ship Stability for Masters and Mates, 7th ed. Oxford: Butterworth-Heinemann, 2008. ISBN 978-0080970936
19. T27 ISGOTT: International Safety Guide for Oil Tankers & Terminals, 5th ed. Revised. London: Witherby& Co. Ltd, 2006. ISBN 978-1856092913
20. T28 Lavery, H.I. Shipboard Operations, 2nd ed. London: Heinemann, 1990. ISBN 0-4434-91094-0
21. T33 Taylor, D.A. Merchant Ship Construction, 4th ed. London: Institute of Marine Engineers, 1998. ISBN 978-1902536002
22. T34 Roberts, P. Watchkeeping safety and cargo management in port. London: The Nautical Institute, 1995. ISBN 1-870077-29-6

Appendix 1

Table 9. Example of a course timetable for operational level (deck)

Day/ Period	1st Period (2.0 hours)	2ndPeriod (2.0 hours)	3rd Period (2.0 hours)
Day1	01. Knowledge of the fundamentals and limitations of the simulators used in the course (0.5 h) **S** 02. Ability to operate and to interpret and analyse information obtained from simulators (1.5 h) **S**	03.Thorough knowledge of and ability to use nautical charts, such as sailing directions, tide tables, notices to mariners, radio navigational warnings and ship's routeing information (0.5 h) **S** and (1 h) **NS** combined 04. The use of routeing in accordance with the General Provisions on Ship's Routeing(0.5 h) **NS**	07. Electronic system of position fixing and navigation (0.5 h) **S** 08. Echo-sounders (0.5 h) **S** 09. Compass – magnetic and gyro (0.5 h) **NS** (briefing) 10. Steering control system (0.5 h) **S**
Day2	12. Thorough knowledge of the content of the International Regulations for Preventing Collisions at Sea, 1972, as amended (2.0 h) **NS**	18. Knowledge of the fundamentals of radar and automatic radar plotting aids(0.5 h) **NS** (briefing) 19. Ability to operate and to interpret and analyse information obtained from radar (1.0 h) **S** 12. Thorough knowledge of the content of the International Regulations for Preventing Collisions at Sea, 1972, as amended (0.5 h) **NS** (debriefing)	20. Principal types of ARPA, their display characteristics, performance standards and the dangers of over-reliance on ARPA(0.5 h)**NS** (briefing) 21. Ability to operate, interpret and analyse information obtained from ARPA (1.0 h) **S** 06. Terrestrial and costal navigation : dead rackoning (0.5 h) **NS** (debriefing)
Day3	06. Terrestrial and costal navigation (1.5 h) **S**, combined with 16. The use of reporting of accordance with the General Principles for Ship Reporting Systems and the VTS procedures (0.5 h) **S**	11. Meteorology (0.5 h): weather systems, reporting procedures and recording systems **NS** (briefing) 15. Knowledge of blind pilotage techniques (1.0 h) **S**, combined with 11. Meteorology (0.5 h) **S**	13. Thorough knowledge of the Principles to be observed in keeping a navigational watch (0.5) **NS** (briefing) 14. The use of information from navigational equipment for maintaining a safe navigational watch (0.5 h) **S**, combined with 11. Meteorology (0.5 h) **S** 17. Knowledge of bridge resource management principles (0.5 h) **NS** (debriefing)

Day4	22. Knowledge of the capability and limitations of ECDIS operations (0.5 h) **NS** (briefing) 23. Proficiency in operation, interpretation, and analysis of information obtained from ECDIS (1.5 h) **S**	23. Proficiency in operation, interpretation, and analysis of information obtained from ECDIS (1.0 h) **S**, combined with 11. Meteorology (1.0 h) **S**	05. Celestial navigation (2.0 h) **NS**
Day5	24. Effect of deadweight, draught, trim, speed and under-keel clearance on turning circles and stopping distances (0.5 h) **S** 25. Effects of wind and current on ship handling (0.5 h) **S** 26. Maneuvers and procedures for rescuing a person overboard (1.0 h) **S**	27. Squat, shallow-water and similar effects (0.5 h) **S** 28. Proper procedures for anchoring and mooring (1.5 h) **S**	29. Knowledge of the effect of cargo, including heavy lifts, on the seaworthiness and stability of the ship (0.5 h) **NS** (briefing) 30. Knowledge of safe handling, stowage and securing of cargoes, including dangerous cargoes, hazardous and harmful cargoes, and their effect on the safety of life and the ship (1.0 h) **S** 29. Knowledge of the effect of cargo, including heavy lifts, on the seaworthiness and stability of the ship (0.5 h) **NS** (debriefing)
Day 6	29. Knowledge of the effect of cargo, including heavy lifts, on the seaworthiness and stability of the ship (0.5 h) **NS** (briefing) 30. Knowledge of safe handling, stowage and securing of cargoes, including dangerous cargoes, hazardous and harmful cargoes, and their effect on the safety of life and the ship (1.0 h) **S** 31. Ability to establish and maintain effective communications during loading and unloading (0.5 h) **NS** (debriefing)	29. Knowledge of the effect of cargo, including heavy lifts, on the seaworthiness and stability of the ship (1.0 h) **NS** 32. Inspect and report defects and damage to cargo spaces, hatch covers and ballast tanks (1.0 h) **NS**	33. Emergency procedures (0.5 h) **NS** (briefing) 33. Emergency procedures (0.5 h) **S** 34.Search and rescue: knowledge of the contents of the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual (1.0 h) **S**
Day 7	35. Visual signaling (1.0 h) **S** 37. Ship construction (1.0 h) **NS**	36. Ship stability (0.5 h): understanding of the fundamentals of watertight integrity **NS** (briefing) 36. Ship stability (1.5 h) **S** (briefing)	valuation with theoretical xam (1.0 h) **NS** valuation in simulators .0 h) **S**