IAMU 2013 Research Project
(No. 2013-1)

Model course to demonstrate and revalidate deck officers' competences by using simulators

By

Univesitat Politècnica de Catalunya (UPC-FNB)

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Univesitat Politècnica de Catalunya (UPC-FNB)

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Model course to demonstrate and revalidate deck officers' competences by using simulators

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Abstract: *In accordance with Part A, Chapter I, Section I/11 Revalidation of Certificates of STCW Code, continued professional competence shall be established, among others, after successfully completing an approved training course or courses. The main objective of this research is to design the contents of the model course using simulation technology to assess seafarers' competence in accordance with the provisions of STCW Code for existing marines who need to upgrade their professional maritime certificates. This should also be done in accordance with the Standards governing the use of simulators, Reg. I/12 of 2010 STCW Code, which will allow a greater cohesion, unification and harmonization between maritime institutions.*

This research is divided into following sections: Section 1 identifies current national revalidation courses; Section 2 provides some general information of the application of simulation technology; Section 3 explains the design and development of the revalidation model course structure and finally Section 4 draws some conclusions of the research.

Keyword*: Maritime Education and Training, Simulation, STCW Code, Revalidation of certificates*

Introduction

International Maritime Organization's (IMO) international convention on Standards of Training, Certification and Watch-keeping for seafarers (STCW) [1] 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 MET institutions throughout EU members, candidate countries and others.

The main objective of this research is to design the contents of a model course using simulation technology to assessment and revalidation seafarers' competences in accordance with the provisions of STCW Code for existing marines who need upgrade their professional maritime certificates in accordance also with the Standards governing the use of simulators, Reg I/12 of 2010 STCW Code (deck officers discipline). In this research project, we only considered the deck officers discipline (deck department) because of the limited time span of the allocated project duration.

The purpose of this revalidation simulation-based model course is to assist maritime training institutes and their teaching staff in organizing and introducing new training courses or in enhancing, updating or supplementing existing training material where the quality and effectiveness of the training courses may thereby be improved. Only those competences relating to ships bridge simulators will be considered for the model course scenario development and testing. This model course is not intended to use simulators instead of ship training, just only will be used to demonstrate and revalidate deck officers' competences by using simulators.

The specific research objectives are:

- Develop a common academic programme using simulation methodology to review and demonstrate competence to issue the marine revalidation certification. This common course will also allow a greater cohesion between international and local requirements and will provide a higher quality assessment.
- Promote the implementation, development, harmonisation and unification of the maritime programme contents considering international standards for the training of seafarers.
- Use of the existing knowledge and experience of maritime education and training institutions using simulation training to achieve experience and to acquire the corresponding skills.
- And finally, prepare a publication, as a guidance tool, of the model contents (theoretical and practical) to demonstrate marine certification competence.

1. Current National Refresher Courses

Assessment and examination methods and practices vary from country to country. This first section will deal with basic research to identify current national refresher and update programme courses. To obtain this information, a communication was sent to all IAMU members. However, these programs are usually written in national languages, we only received 7 answers. After that, they were asked to answer the following simplified questionnaire with 14 questions:

QUESTIONNAIRE IAMU

IAMU Research project "Simulation-based model course to demonstrate seafarers' competence"

Country:

Name of Marine Institution:

1. **Do you have a revalidation program for CoC in your country?**
   - ○ Yes
   - ○ No (if the answer is No, the questionnaire ends at this point)
2. **Is it approved by your government?**
   - ○ Yes
   - ○ No
3. **Which kind of course do you assess?**
   - ○ Deck officers
   - ○ Engineers
   - ○ Both of them
4. **Which kind of topics do you assess?**
   - ○ New regulation for operational level
   - ○ New regulation for management level
   - ○ All STCW competences for operational level
   - ○ All STCW competences for management level
   - ○ Other:

5. Which kind of methodology do you use?

- ○ Online course
- ○ On-site course (face to face)
- ○ On-site course (simulator)

6. Do you use simulators in the course?

- ○ Yes
- ○ No

7. Which kind of simulators?

- ☐ Navigational simulators
- ☐ GMDSS simulators
- ☐ Cargo Handling simulators
- ☐ Engine Room simulators

8. How much time do you devote to the use of simulators on the revalidation course?

- ○ Less than 25% of the time
- ○ Between 25%-50% of the time
- ○ Between 50%-75% of the time
- ○ More than 75% of the time

9. Which of the following types of assessment do you use to evaluate the course participants?

- ☐ Written exam
- ☐ Practical test
- ☐ Simulator
- ☐ A combination of tests (specify)
- ☐ Other: _____

10. Is the material of the course available online?

- ○ Yes
- ○ No

11. **What is the duration of the course? (in hours)**

12. **How many people are applying for revalidation course per year?**

13. **Which are the prerequisites for admission to the course?**

- ○ No prerequisites
- ○ Maritime license time expired
- ○ Other:

14. **Do you obtain any course feedback from shipping companies or course participants?**

- ○ Yes
- ○ No

From the questionnaire we obtained 22 answers (39% of the IAMU memberships). 3 of the 22 institutions surveyed do not have a revalidation program for Certificate of Competence (CoC).

From the answers received, the following figures (see figures 1-4) and results were obtained:

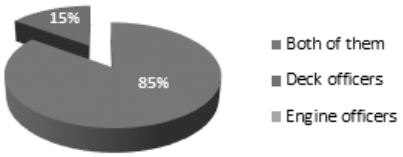

Fig. 1. Question 1: Which kind of course do you assess?

As can be seen in Figure 1, almost all institutions assess both courses, deck and engine officers, and none of them only the engine officers discipline.

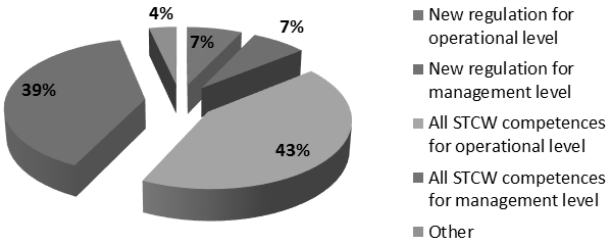

Fig. 2. Question 2: Which kind of topics do you assess?

From figure 2 we can observe that there are some differences concerning the kind of topics that the revalidations course assess.

From the 19 institutions analysed, 17 use simulators in the CoC revalidation course and 8 of them use all types of simulator (see Table 1).

Navigational simulator	17
GMDSS simulator	13
Cargo handling simulator	11
Engine room simulator	12

Table 1. Type of simulator used by institutions

Considering the time devoted to simulation in the revalidation courses analysed, figure 3 shows that more than 75% of the institutions use simulation on the revalidation course between 25% and 50% of the time.

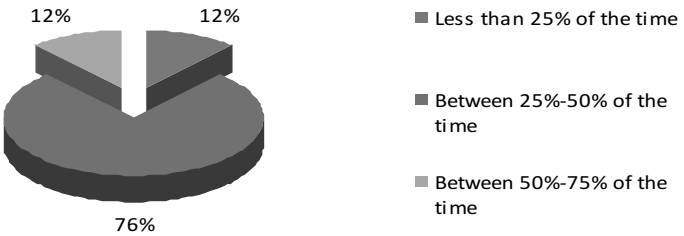

Fig. 3. Question 3: How much time do you devote to the use of simulators on the revalidation course?

Also, course duration varies considerably from country to country (see figure 4) as it depends on government requirements, the kind of basic education received and the requirements regarding the duration of the sea stage.

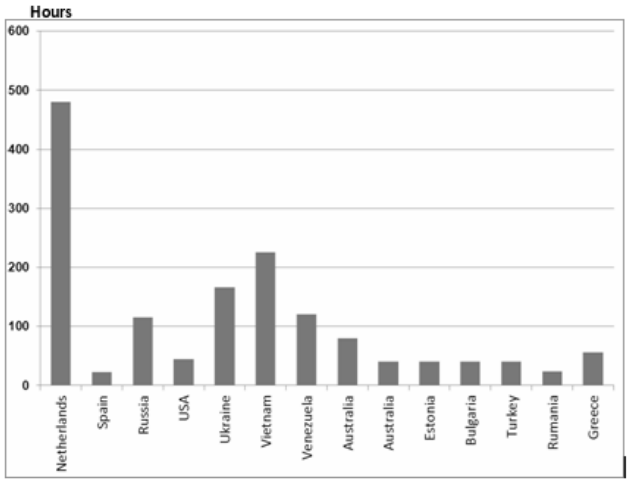

Fig. 4. Question 4: What is the duration of the course?

On the basis of the performed research, we can say that the majority of countries started implementation of CoC revalidation programs for training of marine officers, using navigational simulators, GMDSS simulators, Cargo Handling simulators and engine room simulators during educational process.

However, answers vary considerably from country to country and there is no harmonization with revalidation courses. In light of the fact that STCW Convention 1978 has been amended by the 2010 Manila Amendments and contains new requirements for all seafarers, seafarers revalidating their Certificates of Competency will be required to submit additional evidence to ensure their certificate is valid for service on certain types of ships after 31 December 2016. The development of a simulation model course for revalidation of CoC will provide the required education level and homogenise the approaches of different countries concerning revalidation programs.

2. Application of simulation technology

This section identifies characteristics of maritime simulators (types and classification), simulator training and general conditions of the simulator training.

2.1 Definition of a (maritime) simulator

The progress in the electronics industry has strongly influenced the development and application of simulators for specific marine related training objectives. More and different types of simulators are becoming available to a wider group of users as a basis for the quality training requirement.

A simulator can be described as a device that duplicates limited aspects of the real world. The simulation process recognizes all the classic benefits such as avoidance of costs and dangers associated with operation of actual systems, avoidance of injury and damage and rapid and repeatable exercises.

Within IMO an Inter-sessional Simulator Working Group (ISWG) was established in order to organize and structure simulator related matters for inclusion in the STCW revision. One definition adopted by ISWG [2] reads:

Simulation is a realistic imitation, in real time, of any ship handling, radar and navigation, propulsion, cargo/ballast or other ship-system incorporating an interface suitable for interactive use by the trainee or candidate either within or outside of the operating environment, and complying with the performance standards prescribed in the relevant parts of this section of the STCW code.

Minimum specifications of simulator systems are a requirement to be able to describe any standards and are necessary to use as a baseline to further establish comparisons of systems. The International Maritime Lecturers Association has, through one of its sub-committees on simulation, developed a basic radar navigation simulator specification. This can be considered as a starting point to further describe simulator systems for more advanced training objectives and for other maritime systems [3].

Apart from the functional and technical specifications of a simulator system there will be a need to validate the mathematical models, which serve as a basis for the simulator. Validation can be defined as declaring valid, giving proof and confirmation. As simulation is not real, there will be a need to investigate just how much of a simplification or approximation has been used when devising and modelling the simulator.

It seems there is very little possibility for scientific verification of ship model accuracy versus real life behaviour, especially in difficult conditions such as shallow channels, restricted width waterways and when currents are involved. As indicated by Daggett in an IMSF workshop comparing the simulation with the experience of a knowledgeable expert e.g. a marine pilot, seems to be an accepted, although not always unambiguous, way of validating the simulator performance qualities.

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2.2 Types of maritime simulators

Simulation in the maritime industries has been around for a number of years now but has become widespread after WWII. The introduction of marine radars was probably one of the important triggers to start off simulation of shipboard operations. Although not as structured and as strictly mandatory as in the airline industries there is a tendency to step up maritime simulator training efforts quite considerably and for a number of reasons. The redundancy of the traditional training vessels due to budgetary restrictions, the decrease in training periods on board ship, the more common availability and the improved quality of simulator systems are all relevant causes.

Furthermore, the fact that a simulation system represents a powerful teaching tool, which can lead to more effective training outcomes as well as a more efficient use of available teaching time, adds to the increased popularity of simulation equipment. Additionally, as explained previously, the assessment of competence of seafaring skills can be performed in a lifelike simulation centre, which resembles as closely as possible the real system called “ship”. As IMO is seeing the necessity to assess competence rather than knowledge in order to improve shipping safety and simulators are offering possibilities for such, it seems without doubt that much more emphasis will placed on marine simulation in the years to come.

In general it can be said that any process, which is complex and/or dynamic, is suitable for simulation. In the training of seafaring skills numerous areas are apparent where both elements are present. Maritime simulator training started out as radar and ship handling simulation due to the complexity of the then new radar equipment and the need to research vessel movements and reactions in a more economic way than by extensive trial trips. But in principal any dynamic or complex maritime process

that has to be mastered, especially those which are invisible, such as pumping of cargo or ballast, hold a potential opportunity for modelling and thus training by means of a simulator.

The radar and ship handling simulators are the most well-known and wide spread, but it is quite surprising to see which other types of activities and equipment have become models for a maritime training simulator system and up to date have been developed and installed:

- navigation equipment trainer (NAV)
- communication procedures/GMDSS equipment trainer (COM)
- radar simulator (RAD)
- radar and navigation simulator (NAV/RAD)
- ship handling simulator with/without motion platform/image generation (SHIP)
- fisheries simulator
- inland waterways simulator
- dynamic positioning simulator
- crane handling simulator (CRA)
- vessel traffic management simulator (VTS)
- search and rescue management trainer (SAR)
- oil spill management trainer (SPILL)
- propulsion plant trainer
- steam generation plant trainer
- electrical power plant trainer
- refrigeration plant trainer
- cargo handling trainer (CAR)
- ballast control trainer (BAL)
- dredging ship trainer
- offshore process simulator
- drilling technology simulator

Note: names in brackets and bold, are assigned to refer to each particular type of simulator later on.

This list is not intended to be all-inclusive. As technology advances, new systems, both from the shipping industry as well as within the simulation techniques, are being created with a certain regularity.
From the list it will be clear that all elements of a ship are becoming available for simulation application. This implies that the total "system ship" can be simulated and if criteria on validity, fidelity, reliability and reality are met, justification of the replacement of training vessels by training simulators is becoming imminent[4]. Validity of training relates to the measurement of outcomes of training to ascertain whether the behavioural objectives specified in the training programme have been met. Fidelity is the accuracy and precision in reproduction of the simulated process. Reliability assures that consistent and replicable scores are achieved under the given conditions. Reality indicates that the impression perceived by the learner comprises a physical realism and a behavioural realism in an operating environment. All these aspects are monitored and checked during implementation, operation and evaluation of the equipment by staff and experts.

2.3 Classification of maritime simulators

As training on maritime simulators becomes more commonplace and the international requirements will prescribe or strongly recommend simulator training as a means to acquire competence, there will also appear a need to assess this competence. But in order to assess competence the actual training objectives will have to be described and the appropriate training tools be identified. As the differences

in simulator systems and thus their respective relevance with the training objectives will be considerable, a sub-division of simulation systems will be necessary.

A comparison with the airline industries and their training systems is often done. Not burdened with long traditions or history, the simulators for airmen training have simply been classified levels A to D, denoting an increasing level of sophistication [5]. Attempts of achieving a similar classification in the maritime industries have been undertaken many times in the past years. Personal interests of manufacturers and users have, however, always prevented a common standpoint to be reached. As IMO has included paragraphs on simulator training in the revised STCW requirements, it is necessary to reach a system of classification of simulators which can be related to the training tasks and the subsequent assessment of the competence to perform these shipboard tasks.

A number of suggestions are or have been put forward by various groups of experts. Firstly IMO gathered a group of consultants as advisory input to the STCW revision, which also included a party looking into simulator classes. Secondly the IMSF [6] had established a working group attempting to reach an acceptable classification system. Thirdly a number of the IMO member states have submitted suggestions (USCG submission to IMO in 1994) for classification schedules. But finally the fourth initiative from a classification society has actually resulted in a functional approach and a concrete and workable result.

Reading the above mentioned classification suggestions it was to be assumed that most likely four classes would be decided on in a standardized format, if for no other reason than to be consistent with the airline industry. The phrase full mission seems to have become universally accepted but it does cause confusion as to the extent of "full". Besides that, all the other fairly cryptic terms such as hybrid, multi-task, desktop, combined, etc. etc. seem to cause confusion even among native English speakers. It therefore seems quite acceptable to simply use letters or numbers in order to avoid all kinds of confusion. In addition to either naming system that is chosen, there will have to be exact descriptions of the functional, technical and mathematical qualifications of each category or level.

Despite all the above mentioned efforts and suggested subdivisions to come to a classification system no agreement or acceptance was reached and an individual initiative has now led to the achievement of a workable simulator standard. In the series of their classification rules for maritime establishments (simulator centres, maritime academies, training centres, pilot organizations, manning agents) the class society Det Norske Veritas from Oslo, Norway, has found it beneficial to develop a new standard for maritime simulation equipment which has recently been revised and updated [7]. In this new standard previous work and ideas have been taken into account and reference made to numerous parties within the maritime simulation field.

In the new classification standard, bridge, engine, cargo and communication simulators are dealt with as well as other types. Four classes are distinguished similar to the often-identified subdivision. Only the single task level has been replaced by a class S level, which may include single level, but also gives room for other non-standard systems to be included. A description is given of all classes and the STCW items of competence and other functionalities are related to each level of simulation. Experience within the various working groups showed that, to agree on and accept maritime functionalities as a basis, is simpler for the relevant parties, than to agree on technical design and specifications. Observing DNV delivery listings shows that this standard is a useful and workable reference guide when implementing simulation equipment in maritime training environments.

As indicated, the relevance of the classification of simulator systems will become apparent when the training objectives stated in STCW or in other training curricula, as well as the assessment of competence in those training objectives has to be demonstrated to examiners or other authorities.

Using simulators which are of a class that does not match the training objective, is hardly the way of improving the quality and safety of shipping operations, which after all, is the intention of the efforts described in this thesis.

2.4 Simulation models

The basis of present day maritime simulators is the simulated ships hardware and the software in the form of programs, databases and mathematical models of the simulated phenomena. The hardware is visible and thus easy to evaluate and judge. The software is partly visible: the program will have a man-machine interface through which the instructor communicates with the simulator, the content of the databases is what appears in the visual or radar scene, but the mathematical models control the way the various components behave, such as instruments, vessels, external elements.
Validation of the realism and thus quality of these mathematical models is difficult and will usually contain a large amount of subjectivity. Based on experience and feelings, senior seafarers are often consulted for validation of models such as a ships manoeuvring behaviour. Although this is a valuable input it says little when trying to achieve a quality standard for comparing sophistication of mathematical models and thus of simulator performance. This area, which is practically invisible and lacks transparency, is where those without specific knowledge of the phenomena being simulated, can easily be fooled and tricked into accepting less quality systems than opted for.

The mathematical models in ship bridge simulations are based on extrapolation of hydrodynamic coefficients from towing tank tests for a restricted number of hull shapes. For deep and unrestricted waters these data are usually accurate enough to not cause apparent discrepancies. However, shallow water effects, anchoring forces and ship/ship, ship/shore interactions are far more difficult to quantify and contain in a mathematical formula, so extensive research and testing is required to achieve quality results. [8]

But as research is costly, so will the accurate sophisticated mathematical models be. This in turn results in the simulator system becoming more costly due to both the more expensive models as well as the more powerful computers required to handle the more complex mathematical model calculations. Consequently, offers of highly accurate and sophisticated simulation systems for mass software prices should be regarded with utmost caution as it is unlikely that a high degree of sophistication can be achieved at a low degree of cost.

That means that the training objectives to be reached with the simulator exercises will play a crucial role in deciding the sophistication and thus the final cost of simulation facilities. Quality can be good and acceptable at any price, but it should be considered in relation to the level of sophistication that is required to reach a training goal.

2.5 Training

2.5.1 Types of simulator training

A simulator is a training tool, which has to be integrated into a total training programme. This means that a simulator can and should be used for training of normal and emergency operations. This is possible without endangering people or environment, even if the training actions are not performed properly. Once the quality of the training efforts has been assured as indicated above, it will become necessary to distinguish the type of training that is to be performed, especially related to the seafaring profession. The training can be done in different modes and at various levels. If the training programme is of a modular design the specific training requirements can be matched with each module.

Investigation into the design of training scenarios will offer a possible division of training into five basic types described as follows:

- *team training:* a team is a group in which decisions are made based on evaluation of information in order to execute the necessary operation. Team training is carried out to establish or to improve a team as a means to lead to decision training.

- *operator training:* operator training is required in order to train a person in proper equipment operation procedures. Ships are equipment prone so operator training is highly relevant in the maritime profession.

- *decision making training:* decision making training is done in order to train persons in making the right decisions, based on evaluation of a given situation and to carry out the necessary action to reach a defined goal. In many situations the decision maker can communicate directly with the equipment rather than through an operator. The decision maker thus becomes an operator.

- *procedure training:* procedure training takes place in order to train a group of persons the correct execution of a specific procedure.

- *maintenance training:* this is done in order to train individuals in either technical or condition control maintenance.

Without proper identification of the type of training which is to be performed it will be more difficult to reach a quality composition of the training in general or training by means of simulators in particular.

2.5.2 Training programme development

In order to reach a quality simulator training programme, which has elements that can be audited within a quality assurance context, the items, which make up such a programme shall be distinguished and described.

- ***Programme objectives.***

The structure of a training programme is critical in a simulator based training system. It is the machine for directing the efforts of students and teacher towards the accomplishment of the desired training objectives. It is also the plan for ensuring that maximum benefits are derived from the available simulator time. Furthermore the programme structure should be helpful to less experienced instructors in reaching the desired training objectives.
Training programme objectives can be stated in a number of ways and on a number of levels unlike the unambiguousness of a learning objective. The programme objectives can be stated in a very

flexible way in general terms not specifically tied to any particular topic areas or simulator goals e.g. *demonstrate proficiency in ship handling.*

Preferable is a more structured description, specific to a topic area covered within the training programme such as: *proficiency in handling a 80.000 dwt tanker in a 500 meter wide channel under specified environmental conditions.*

It will be dependent on where a programme is developed and for what target group, how the overall composition will be. Is it for inexperienced cadets or a refresher programme for serving seafarers? Will the programme be given on a commercial basis for a shipping company, or is it part of a national (subsidized) educational programme?

- ***Duration.***

In trying to determine the right duration of a training programme a number of issues are to be taken into consideration:

a. nature of the skills to be trained

b. level of knowledge or skills of trainees

c. cost allowable for the programme

d. time availability of the trainees.

In practice this often means training programmes ranging from 1 to 5 days, or even longer depending on the conditions and requirements. The assumption is made here that this involves stand-alone training programmes such as courses to industry or other one-time target groups. However when incorporating simulator training into an educational programme of a college or school, the conditions will be quite different. Costs will probably be covered in the collective school budget. Time will depend on space within the syllabus and training sessions can be spread over a longer period of the year. In this case many alternatives are possible. As for the duration of sessions, almost twenty years' experience at the Dutch Maritime Simulator Training Centre has shown that less than two hours including briefing and debriefing, is not efficient and much longer than four hours in real time training becomes too far remote from reality. However all alternatives to this division exist.

- ***Group size.***

Simulator training group sizes depend on many factors e.g. the availability of students, instructors, level of training, configuration of the simulator. The principal factor is that all students should have adequate simulator hands-on opportunities to acquire the desired skills, transfer and retain them and this within the operational environment.
Based on the experience on the simulators at MSTC, an indication in "normal" simulator institutions is that more than six to eight students in one ship bridge would only allow for demonstrative exercises. From three to six trainees in a group is a size recommended for most ship bridge oriented training objectives. Again it should be emphasized that these are not hard figures. Groups smaller than three are ideal in order to accomplish the development of highly specialized skills. Considerable individualized instruction can be given and ample hands-on training opportunity is available.

- ***Instructor guide.***

A proper instructor guide should be developed and provided to all instructors who are going to be involved in the training programme. In its ideal form it should contain information about the structure of the training programme, the strategy used, meaning detailed methodology and timetable for each period of training and the materials used to enhance the training process. Such a guide will provide detailed guidance to the instructor and ensure the relevant issues are covered in the appropriate manner

and standardize to some extent the content of the training programme in the case more than one instructor conducts a programme.

What should ideally be included in the guide is listed as follows:

a. programme introduction
b. purpose of the training programme
c. description of the programme
d. schedules and timetables
e. simulator familiarization
f. description of the simulator capabilities and limitations
g. demonstration of equipment
h. demonstration of models
i. standing orders, where applicable
j. training category
k. specific training objectives to be achieved
l. detailed lesson guides for each session or hour
m. course evaluation and student debriefing
n. Appendices such as handouts, tests, references.

- ***Number of exercises.***

The question of how many exercises to be used in a simulator training programme in order to allow for sufficient practice on various sequences of tasks will of course depend on the training objectives to be achieved. In general it could be said that for every objective listed there should be at least two, more or less similar, different exercises available. If many variable parameters are included in the type of training then the amount of exercises should increase correspondingly.

If too few exercises with too few different conditions are used, there is a danger that students will acquire only specialized skills related to those conditions. Similarly with too few different exercises the trainees could become over-confident of their abilities and have the impression that they have been able to master a certain machine or system, while in reality there could be many more different situations to be encountered.

- ***Supporting material.***

The types of material available for the instructor to use in the classroom session or during briefing activities is another element, which adds to the effectiveness of simulator based training programmes. There are several types of material and media that have been used successfully in the past and the training equipment technology is advancing at the same pace as that of the simulators themselves:

- traditional blackboards or modern whiteboards
- scale charts of the exercise areas
- overhead projector sheets

- sound slide presentations
- computer-generated feedback displays
- remote and video monitoring of simulator activities
- cbt training modules relating to the training objectives
- computerized assessment and evaluation programmes.

On the selection of materials to use a few points should be considered:

- the subject matter content of each training objective,
- the skill level of the students,
- the strengths and weaknesses of the instructional staff.

Consideration of these factors and assuring they are of the best achievable level, will add to the overall quality of the simulator training programmes.

2.5.3 Simulator exercise development

- ***Exercise design.***

As a guideline nine steps can be distinguished in the process of designing simulator exercises as follows:

a. Step 1 - Introduction.
b. Step 2 - Learning objectives.
c. Step 3 - Duration of exercise.
d. Step 4 - Number of students per instructor.
e. Step 5 - Special instructions for the instructor.
f. Step 6 - Special instructions to the students.
g. Step 7 - Status.
h. Step 9 - Evaluation.

The evaluation of the effectiveness and the quality of the exercise will come from the debriefing and from the students' scoring. Evaluation of the students' performance is important if any marks have to be given, but depending on the type of simulator is also rather complex and possibly not always as objective as required. The evaluation of programme or course and exercise within that programme or course can be done by means of a number of questions, written and in a questionnaire form.

- ***Application of the design model.***

This exercise design model with the nine steps is an often used example format. It is not meant to be adapted rigidly, but can be used and amended according to own practice and experience. However, if especially when starting to work with simulators, the model is followed very formally as the guideline, it should easily be possible to create the proper type and quality of exercises.
An advantage of doing this task according to a standard menu is that a well-documented library of exercises can be established and that colleagues used to the same standard will be able to exchange

and understand the exercises and even substitute the instructor without causing much disturbance in the training continuity.

- ***Briefing and debriefing.***

As mentioned earlier the briefing and especially the debriefing sessions should be taken seriously as they provide valuable information in many ways. The time needed shall be specified with the exercise in the training programme and will depend on the level of the students, the complexity of the simulator system and of the exercise.
Briefing can be quite well estimated and documented if the level of the trainees is known or assumed. Debriefing however will depend on the trainees' performance and the amount of discussion coming out of the group. Setting time and giving exact rules on how this will take place is rather useless.
One remark from personal experience is: be generous in allocating time for the debriefing. It is rather frustrating and a definite loss of training value if the debriefing cannot be done properly because of time constraints.

2.5.4 Example training programmes

- ***IMO model courses***

In order to give assistance to those starting out using simulators in their training programmes a number of model menus have been developed as guidance for such implementation.
IMO, through contributions and sponsoring governments has invested heavily in the further improvement of maritime training and education programmes. The well-known World Maritime University, being a prominent example was established in 1983 under the philosophy that it would be more effective to bring the developing world to the experts, than sending the experts to the developing world.
Once graduated from WMU the newly trained teachers and instructors upon returning to their countries are often faced with a lack of teaching programmes and materials. For this purpose standard menus to conduct courses in numerous maritime subjects have been developed in the form of the so-called IMO Model Courses [9].

For the purpose of simulator training the following model courses are available:

a. 1.07 Radar Navigation, Radar Plotting, Use of ARPA
b. 1.08 Radar, ARPA, Bridge Teamwork, Search and Rescue
c. 1.09 Radar Simulator (incorporated in 1.07 and 1.08 in 2007)
d. 1.22 Ship Simulator and Bridge Teamwork
e. 2.06 Oil Tanker Cargo and Ballast Handling Simulator
f. 2.07 Engine Room Simulator

Especially those courses, relating to simulation application are, or have been under revision by IMO and were made available within the transition period from STCW78 to STCW95 ending in February 2002. This clearly illustrates the importance and the ongoing development of this specific area in MET.

- ***MNTB***

With the introduction of STCW95 a need was felt in many countries to further expand and update their existing materials for guidance and requirements of maritime training activities. The UK Merchant Navy Training Board in consultation with the Marine Safety Agency has drawn up criteria for the approval of education and training programmes. In conjunction with this, guidance for the design and delivery of the related training programmes has been developed and published under the name

"Navigation and Radar Simulator Training" [10]. The topics covered range from the basic radar and ARPA training to comprehensive bridge team management training.

- ***MASSTER***

Another interesting initiative is the development of what is called a Maritime Standardized Simulator Training Exercises Register, MASSTER. In this project which has taken place under the EU's 4th Framework Programme, Waterborne Transport, the MASSTER project has produced a number of new exercise scenario descriptions which can be implemented on the relevant types of simulators. Probably the limited extent of the project has dictated that only a few scenarios have been described and developed. In areas which were identified as having had little formal scenario design available, some 31 new descriptions have been produced [11].
The project name suggests that this register will include all inclusive exercise scenario descriptions, which unfortunately is not the case. This means that one's own initiative and development is still an essential skill for a qualified simulator instructor.

- ***Various***

Some simulator equipment manufacturers have been requested by customers to provide standard training packages with deliveries of simulators. A number of these so-called "canned" exercise programmes are publicly available and open to wider user groups. New and specific areas are being developed as new simulator functionalities are becoming available.

2.5.5 Assessment in simulator training

It is common practice that all training and educational efforts will include a stage of assessment and evaluation to monitor if the training objectives have been met. Over the years, various systems for evaluation of education and training have been developed and applied. Usually every teaching or training institution will be involved in evaluation and assessment. However to what extent and by which methods is an area which has been argued by educationalists in the past and will continue to be open for discussion [12]. With the revised STCW 95 the evaluation of skills has been indicated as the assessment of competences and this is presently a major effort of the maritime training establishments.

The method used to assess will depend on the training tool, which is applied. Furthermore the actual skill, which is supposed to be acquired, and which should be evaluated will differ and range from very elementary, like making a certain knot, to very complex, like piloting a vessel. In competence based training the evaluation can preferably be done with or on the training tool, which has been used. In the case of acquiring complex skills this could mean on board a vessel or on the tool, which was used to represent the vessel, such as a simulator.

The reason for assessment is to give an answer to all these questions. Without a proper answer the efforts of the training might be wasted. However, finding these answers is often a difficult process:

- first, there are numerous aspects which can be assessed in training programmes.
- next, the criteria against which these are measured are open to discussion.
- finally, the methodology used for evaluation can vary from system to system and from programme to programme [13].

Where assessment is considered difficult in a normal training or educational situation, assessment of simulator training can be considered to be even more complex. More often than not, different, rather subjective means are used, which seem hardly justifiable with such sophisticated tools as simulator systems. Therefore the need appears for an assessment and evaluation system, which matches the level

of sophistication of the simulators, offers an objective evaluation and is as instructor/examiner friendly as possible.
Although not done in a universally structured manner as with the assessment of other training systems, some attempts are being made by training providers to assess the trainee performance and thus effectiveness of simulator training. An overview of the methods presently used is given hereafter:

- ***Checklists***

One of the most common methods used in the assessment or evaluation of practical training has been by means of a checklist. The instructor or examiner will, on a one to one basis, observe and monitor the trainee's performance either remotely or in physical presence of the trainee. Checklists relevant to the teaching objective can be made up in advance and will be manually filled out by the instructor. The advantage of this method is the direct observation by the instructor or examiner of the trainee's performance. Obviously there are many more disadvantages: subjectivity can easily creep in to the overall assessment; evaluating more than one trainee simultaneously becomes difficult; appropriate records have to be kept of all the individual performances.

- ***Plots and print-outs***

Either independently or together with checklists or other means, a commonly used method for evaluating student performance on a (bridge)simulator is by means of a plot of the sailed track and a printout of any relevant parameters monitored during the exercise. By means of a colour plotter on a real or drawn nautical chart section the exact path of the trainee's vessel and that of any interactive relevant traffic ships can be plotted with position and time indication. The advantages of a plot are the visual observation that can be made and a quick indication of position and time used to perform a certain exercise route. Furthermore what the plotter indicates cannot be manipulated, in other words a certain level of objectivity is assured. The disadvantage is the limited information that can be obtained from the plot. None of the other parameter values, which are relevant in the simulation exercise, are given. This makes the use of other means such as checklist or printouts together with the plot essential.

A printer can be programmed to provide any of the relevant simulated parameter values which can be chosen by the instructor in advance, either continuous or at selected time intervals. The advantages of the printouts are that practically any simulated parameter can be made available and that the figures as such, are objective. The disadvantage is that the lists of parameter values have to be carefully considered and interpreted in order to form an impression of the trainee's performance. This usually cannot be done immediately, which leaves the exercise with somewhat of an open end. The assessment outcome will only be available sometime later, depending on the number of parameters logged and the efforts of the assessor.

- ***Examiner evaluation***

The easiest method by far is observing of the trainee by the instructor/examiner who then mentally sets an evaluation to the performance. This method contains a number of shortcomings and might contain a high level of subjectivity if used exclusively. Up to now, this has been common practice in a most training occasions. The obvious shortcomings of this method are the influence of the personal knowledge and attitude of the examiner. Often these examiners are retired ship's officers, captains or pilots who are not necessarily up to date with the present day procedures in the real life situation. Furthermore the personal feelings and preferences of the examiner can influence the outcome. Therefore, the great amount of subjectivity, which can enter the evaluation, cannot be justified, neither towards the trainee nor the supporting or sponsoring parties, such as employer, authority or training institute. Within a quality training organization attempts will thus be to avoid such undesirable practice [14].

In order to acquire an objective assessment of the trainees performance in simulator training sessions, an electronic system which monitors, measures, compares and records a number of parameters could be a useful tool to assist the instructor or examiner. Criterion values for the various parameters can be set by the instructor in advance and will be the same for every trainee performing a particular exercise. This will add to the objectivity of the instructors' evaluation. Furthermore an evaluation which is done in such a structured manner will enable training results to be compared, training systems to be justified and the quality of training programmes to be controlled and ensured.

Based on industry observations and previous research ideas, a format has been established for the inclusion of the necessary parameters in an evaluation system for bridge simulation procedures. If the relevant parameters have been distinguished the actual measurement of the effectiveness of the training session can be recorded.

As the process of sailing a vessel can be regarded as an "open" process an enormous number of influencing factors have to be taken into account. These factors should first be divided into groups in order to make further processing more structured, e.g.:

- types of exercise area's
- internal parameters of the vessel
- external parameters of traffic and environment.

Types of exercise area's.

Area types will first have to be determined in order to distinguish the various and different types of parameters, which are relevant:

- open sea without draft limitations/ with draft limitations
- coastal areas without draft limitations/ with draft limitations
- port areas without draft limitations/ with draft limitations.

With regards to the vessel a considerable amount of criteria are to be monitored and measured, representing the internal elements, which can be influenced and adjusted by the trainee. These will include, but are not necessarily limited to:

- ships' heading
- drift angle
- disturbance of navigation systems
- rate of turn
- yaw
- course offset
- ships' speed
- engine revolutions

- engine command
- ships' motion: heave, pitch, roll
- ships' position geographically
- ships' position in relation to voyage plan
- ships' distance and bearing to coast
- ships' distance and bearing to other vessels
- depth sounding

Finally the external elements such as traffic, weather, disturbances, which will all influence the way the trainee performs should be included in the evaluation of the exercise which is taking place. These will include but are not limited to:

- traffic vessels distance and cpa
- traffic vessels speed and course
- traffic vessels sound or light signals
- visibility
- wind force
- sea state
- radar disturbances
- communication system disturbances

2.5.6 Criteria in training assessment

In order to evaluate a trainees performance a criterion or standard is required against which the achievements can be measured. Setting this criterion value is essential but at the same time difficult and complex. Many factors will influence the criterion value and they can possibly change in time as well. Furthermore the criterion for certain phenomena might be quite different for the various levels of training performed on the simulator system [15].
This implies that it would seem illogical for a simulator manufacturer, to try to set these criteria, should the system incorporate an assessment tool. Besides, setting the criteria would require very specific knowledge of the daily practice of the simulated process, which is possibly not continuously available at a manufacturers disposal. Creating the tool by means of which the user can set their own criterion values seems far more desirable. This relieves the manufacturer of the responsibility of choosing the right criteria and of being accused of trying to influence training standards and it offers the user a far more flexible and universally applicable system.

The criterion values to be used can be acquired in many ways:

- the previous instructor experience

- the average results of colleague instructors
- the average results of previous trainees
- the required examination levels
- internationally recognized standard values etc.

Preferably the actual monitoring and measuring of parameters against criterion values is best done online by the computer of the simulator, as this will lead to instantaneous and objective evaluation. Such systems are now becoming available in the industry and seem essential to have included in a simulator if it is to be used for competency testing. It is also necessary to develop and apply this type of assessment system in order to justify the quality level when using training simulators to improve performance and reduce costs.
Based on the above-described distinctions, simulator training can be considered somewhere in between teaching and training. It is not only transfer of knowledge we are aiming for, but it is certainly not only a matter of mastering skills either. Knowledge achieved through teaching is used here in a training scenario, to perform in the right way, exhibiting skills in order to reach the set objective and thus show competence [16].

It is perhaps because evaluation of training calls for a change from pure testing to something which is in between testing and matching or comparing with certain existing standards of skill or expertise, that it appears to have remained an underdeveloped area ever since training simulators were introduced. Apart from the fact that the test methodology and criteria are difficult to determine the problem of objectivity in evaluation techniques also causes major disturbances and frustration. Certain objective methods of evaluation and measurement have been developed and accepted over the years. But comparing a performance or an achievement with set standards or criteria in an unstructured and purely mental way, without e.g. colleagues verification, offers the assessor the opportunity to come to a totally subjective opinion. Another probable reason why evaluation of simulator training has been in the grey zone for such a long time is that although non-objective evaluation is not desirable, true objectiveness is difficult to achieve.

The elements required for proper evaluation are as follows [17]:

- methodology (how to evaluate and with which tools),
- criteria (which outcome is required),
- objectivity (outcome not influenced),
- reliability (measurement consistency),
- validity (measure what is intended).

If the methodology is correct, a certain objectivity of the evaluation can be achieved according to the criteria that have been set. With the right criteria and methodology, sufficient validity can be assured while reliability comes with the tool used. The implementation of an evaluation method, which offers the required objectivity, is aimed for and it seems that this has been achieved to an acceptable degree by means of a modern and effective solution.

Defining the values in the various competences as indicated in STCW95 as well as the optimum number of trainees per training session is an area where considerable further research opportunities are beckoning.

TEC system

In the present generations of simulators new instructor operating systems have been introduced enabling the trainer to divide his/her attention in a more evenly way. As the simulator systems are based on a "one instructor" philosophy a number of tasks will have to be taken over by the machine if the goal is to handle more trainees and more activities at the same time. Computer power is amply available nowadays, at a very reasonable price. This should be utilized to the maximum to perform certain tasks, as computers are easier to acquire than qualified instructors.

Which elements of an instructors' task that could be taken over by machines is indicated by the abbreviation TEC, which stands for Training and Evaluation Control. These are the elements seen to be dealt with by the instructor [18].

But the main advantage of this approach is, that the criteria for the measuring and evaluation, are set by the instructor in advance. Over and over again, exactly the same standards can be used for each student and all will be treated in the same mathematical, mechanical way. Neither the attitude of examiner or examinee makes a difference anymore in the scoring. All scores will be to the same standards, ensuring objectivity and reliability.

SEA System

Research and experiments, based on the above described evaluation editor as example, led to the development of an online computerized assessment tool for open processes of simulator training, such as ship's bridge related systems. To start with, an attempt was made to specify the format, layout and the software comprising this tool. The result is being incorporated in the new generations bridge related simulators, enabling the instructor to perform assessment and evaluation procedures of a relatively objective nature [19].

The particular unit can be called Simulator Exercise Assessment system or SEA system with a coincidentally relevant acronym. Although there are different interpretations of the term assessment this name will be utilized as it corresponds with what is commonplace in maritime training through among others the most recent IMO STCW Convention revision. Nevertheless it should be realized that full assessment of a persons' competence to perform, for instance, duties of a chief officer, will encompass more than just the skills acquired or demonstrated on a simulator. However, those elements, which are covered by the simulator, can be handled by this SEA system.

2.6 CONDITIONS

2.6.1 Quality components of simulator training

If a training system or programme is supposed to improve and safeguard job performance, then the quality of the training system will be an essential factor to reach this goal. The quality of that training system will depend on a number of elements, whereby the available teaching tools and equipment are one of the factors. Besides these the training programme and the instructor are elements defining the overall quality of training.

The four elements involved in any training activity show an intensive interaction:

- 1. training programme
- 2. training tool (simulator)
- 3. instructor
- 4. student

These four elements are also dependent on each other. Any changes to one of the elements will influence the other. This implies that the various elements should not be considered separately but always in relation to one-another.

The revised STCW has introduced a new way of approaching the seafaring profession. Instead of certifying personnel on the basis of the knowledge they have, the new system looks at the skill that is demanded from a person and describes this as a level or item of competence to be achieved. Some call this descriptive method the functional approach and it has been used in the revised STCW to give an overall breakdown of the competences, which are required of a seafarer, at a certain level, in a certain function group. These mandatory competences are laid down in the tables in the STCW 95/2010 Code Part A. Additionally the underpinning knowledge required, as well as the criteria to evaluate if a trainee possesses this competence, are given in the tabular format. Additionally the various methodologies suggested to demonstrate the competence are addressed in these tables.

One of the methods to demonstrate competence for a number of the objectives, is the application of simulator equipment. From IMSF and IMLA conferences papers it is clear that there is a wide growth of the use of simulators for training and assessing the various competences. However the level of simulators, the training courses, the personnel operating them and the assessment procedures are not necessarily proven to be of the standard, which ensures that the required results are achieved.

Therefore a Quality Assurance system should be introduced to guarantee that the efforts made are not wasted and rules will be set for equipment, personnel and facilities and subsequently for software, training programmes and assessment methods. This has been recognized in the revision of the STCW and sections about QA have been included in the final document. However, as the STCW document is to be seen as a basic framework, rather little concrete advice is given on how such a QA system shall be implemented into the maritime training field as well as how to apply such QA to the tools used.

One relevant effort has been made by a classification society to assist in the overall improvement of the maritime training business, by means of introducing rules for the classification of maritime academies, maritime training centres and maritime simulator centres [20]. Implementation of these DNV rules will at least set a framework by means of which an independent external party has the possibility to ensure that both a universal comparable standard level is achieved and that an internal process is initiated to make staff aware of the necessity to scrutinize and document their way of thinking and working.
A further standard format of certification of competence of personnel has been developed and can, on a voluntary basis similar to the above mentioned rules, be used to create demonstrable compliance with requirements regarding knowledge, skills, experience and attitude in a certain profession [21].

2.6.2 Validation of simulator training

A simulator is a tool in a learning process so the requirement to measure the effect of the use of that tool in reaching the learning objective is as valid as with any other tool. However in the case of assessment of simulation training the developments have been limited. This can be seen as partly due to the complexity of the training exercises, partly due to the difficulty of agreeing on acceptable standards.
Finding out how effective a training session has been is usually the final stage in the training process. The process of assessing this effectiveness is called validation, of which two parts can be distinguished: internal and external validation. [22]

Internal validation is finding out if a training activity has reached its objective. External validation is distinguishing if former trainees have applied what they have learned in training to the job context and were able to perform to the level expected of them after training.

Validation procedures will vary but should at least include approval and inspection of the content of the training programme, the training methods, the training facilities and environment, the entry qualification of trainees, qualification and experience of the instructors and the assessment systems. Validation of training is often carried out by a group of qualified experts and is normally subject to regular auditing and revalidation and updating of programmes at intervals of 5 to 10 years.

2.6.3 Transfer of simulator learning and training

In a Caorf study [23] to assess the equivalence of varied amounts of simulator experience to simulator applicable skills assumedly acquired during the first one year of cadet sea time, a number of students with various levels of experience were involved. Groups of students were compared of whom some had sea experience and some had not. After simulator training that group scored equal or better than the group with only sea experience. Also results of students after longer simulator training were compared with those having shorter training and the first group scored better.
This resulted in the conclusions that there is a definite effect of simulator training in the improvement of watchkeeping behaviours and skills. Secondly, the study concluded that simulator training may well enhance sea training and/or provide a strong base on which to prepare cadets for effective sea training.
In another Caorf study [24] into the shiphandling in the Port of Valdez fairway the conclusions based on the test-groups results were that the performance was significantly improving from the first to the last test run which supported the assumption that acquisition of shiphandling skill through simulation parallels the process of skill acquisition in the real world. This proved further evidence of the validity of the simulator and the usage as a training tool.

In 1987 at the 4th Marsim conference in Trondheim [25] a paper on the effects of simulator training on performance concluded that, although some studies on the transfer of training effect from flight simulators to real aircraft sometimes give contradictory results, there is substantial evidence indicating that simulators are indeed highly effective training devices provided they are used in well-designed training programs by highly motivated simulator instructors.

In 1988 at the 5th INSLC gathering a further elaboration was given on the transfer of maritime training [26] confirming the above, that a decrease of effect of transfer is apparent with a poor programme structure, time restrictions, personality of the trainee and input of the instructor. However based on other trials it can be concluded that effective transfer of learning and skills acquisition took place in 80% of the trainees, which could probably be increased if a number of limiting factors were removed. Finally, further evidence that transfer is taking place was achieved by work carried out at AMC in 1986 when practicing emergency manoeuvres was carried out using both real and simulated vessels [27]. This was the first known occasion that this had been attempted to any realistic degree.
As the methods of determination and optimization of training effectiveness and transfer of learning only provide relative information, it was recommended [28] to refine the then current methodology of training effectiveness measurement. This resulted in a redesign of the transfer experiments for perceptual-motoric skills on both general skill items as well as in the context of man-machine skill items. For many applications the rate of training is at least as important as its range, both with respect to training effectiveness, as well as cost effectiveness. Because of disappointing experiences, some decision makers are becoming more critical of the idea that simulator training is a solution to all training problems. As a result they advocate a more structured approach to the design, implementation and evaluation of simulator based training systems and programmes.

Another less known area of simulation applications is that of the road driving simulators. Here the validity of training and systems is of equal importance to achieve the most efficient level of transfer [29].In driving simulators limitations such as closer distance to environment objects, visually more complex and more detailed features, make it more difficult to reach the required level of realism than e.g. in flight simulators. Consequently this then leads to the discussion how realistic the simulation

need be, in order to reach the required transfer of training. In order to evaluate this a distinction is to be made which tasks are supposed to be trained by a particular simulator. And which tasks are most effected by the present limitations and which are not. Tasks which relate to the operational procedures of a machine and system are usually simple to replicate. This type of simulation therefore usually has a high level of validity which can result in a high level of transfer.

In the MSA Report 340 [30] numerous elements relating to the training effectiveness and application of maritime simulation have been researched and are highlighted. It is discussed that transfer can refer to two concepts. It can apply to a situation where skills are transferred from a simulator to a similar operational setting (skill based learning) or to a situation where the acquired skills may be used in novel situations through cognitive skills of problem-solving and decision-making (presently called competence based learning). Three models of transfer are found in the literature:

- transfer is dependent on identical elements in both real and simulated task;
- transfer is dependent on the extent to which there is similarity rather than identically between real and simulated situation;
- transfer depends on the motivation of the learner to want to acquire and apply new skills.

Total transfer is rare according to this study, further learning in an operational setting is usually required. Transfer is also not uniform: some skills will transfer more easily and efficiently than others. The importance of transfer in simulator-based training, is that it is the key measure of the effectiveness of that training and consequently the justification of the performance improvement which in turn can be brought into relation with the number of accidents which might occur.

2.6.4 Transfer of training in practice

Undoubtedly one of the most concrete and substantial evidences of the transfer of learning has come from a Dutch research project [31] which was undertaken in order to identify which factors are of value when a simulator is used as a teaching tool. The main focus in this study was the transfer and the effectiveness element.

The question asked by the study, was to identify if it is possible, by means of a simulator, to achieve those skills which are required in the real life situation. Or stated otherwise: what is the validity of a simulator in relation to transfer of learning or training? This is usually done through comparison of two pilot groups where by one is trained on the simulator and then measured in real life and the other is only trained and measured in real life.

Initially three types of tasks were identified in Boer's study: procedural, cognitive and perceptive-motoric.

- For procedural tasks in which the training environment is identical to reality the success of procedure trainers and operational simulators is beyond doubt, such as for starting up an engine, working off a checklist.
- As for the cognitive tasks with interaction with a symbolic representation of the real world such as with radars, blind-vue diagrams and schematically drawings of the system on screens, the outcome was that there is no difference between the modelled behaviour and the real life system dynamics.
- For the third group of tasks such as driving, flying, sailing, the imitation of the outside world is most difficult but also essential in order to create the same kind of reactions as the outside

world would trigger. This realistic interaction proved difficult when simulation first entered the training arena, but has now reached a different level due to enormous advances in technology.

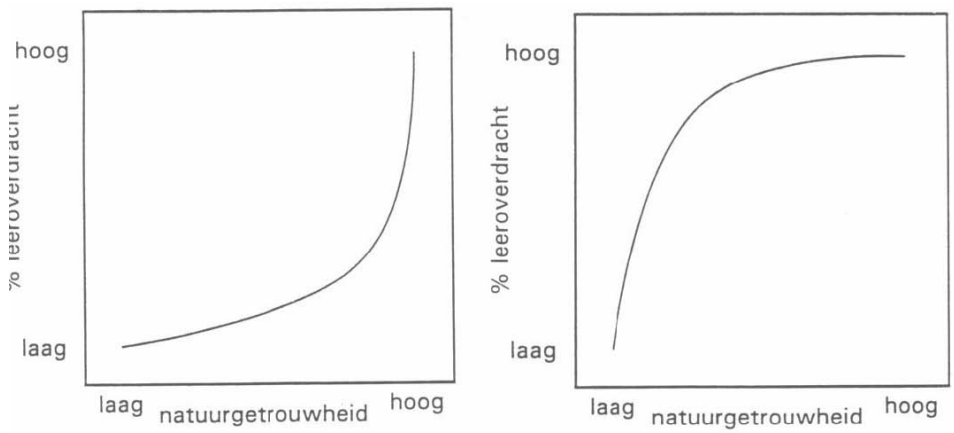
Based on Boer's work there is no discussion on the existence a of a relationship between the level of realism and the amount of transfer of learning. This begins at no transfer if there is no realism and ends at optimal transfer if the level of realism is absolute. The only discussion Boer distinguishes concerns the form of transfer and in this matter there are two streams:

- one by the learning theoreticians who have mainly studied the transfer from one perceptive-motoric task to another and claim that the skills are very specifically related to the task situation.

- the other stream of practice oriented researchers has mainly been studying transfer from simulators to real life. Their conclusions are that a very satisfactory transfer takes place even if the simulated environment shows considerable difference on important features from the real situation. This relationship graphic is shown right in figure 5.

Apparently the two streams agree that considerable transfer is possible, but conditions under which the simulation is run, affect the transfer differently. In the graphs taken from the original study "leeroverdracht" means transfer, shown on the vertical axis and "natuurgetrouwheid" means realism, indicated on the horizontal axis. "Hoog" and "Laag" are respectively, high and low.

Fig. 5. Transfer % vs. realism

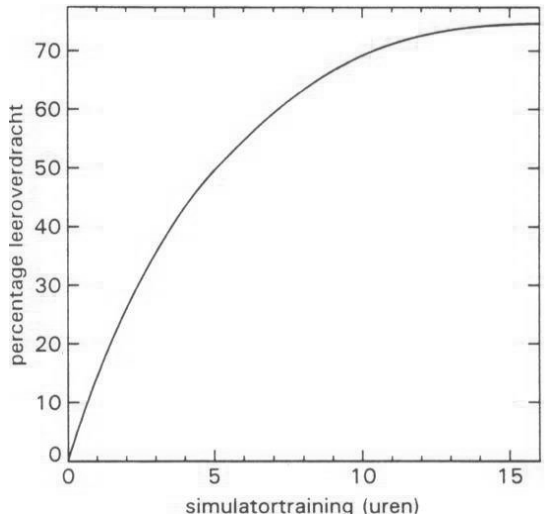


In the same study, the relationship between amounts of transfer versus duration of training was studied. For simulator training it was concluded that the requirement for realistic simulation increases, as the performance requirements in real life increase.

This is further explained as: with increase of the simulated performance and importance of the simulated environment, there is a deceleration of relevant transfer to the real life task. This is shown in figure 6. In other words: as the skill in the simulator task further develops and the importance of the realism of the simulated environment grows, less and less is learned in the simulator, which is relevant and transferable for the real life task. This assumption is confirmed very convincingly through analyses [32] of numerous simulator-to-real life transfer studies.

It is now of interest to quantify the amount of transfer, if possible at all. From the previously quoted studyit has been indicated that the learning theoreticians have been able to arrive at research figure outcomes ranging from 35 to 65 %. Those known as the simulation learners tend to arrive at lower figures such as averages of 31%, but from a set ranging between –11% and +90 %. In another case this was improved to around 50%. Finally a study with Leopard tank simulation runs showed learning transfer percentages of between 50 and 90 %.

Fig. 6. Transfer % vs. training hours (example)



Based on the previous research efforts into the actual effect of simulator training on trainee performance when involved in real life situations the phenomena of omission of sea-time for simulator time seems to be a concluding action showing the confidence placed on this particular learning tool. There are numerous ratios used worldwide for simulator-time versus sea-time ranging from 1:1 up to 1:12 which differ per country. These figures sometimes seem based on gut feelings or practical assumptions but not very often on published research. The following figures have been found through personal observations: Germany 1:1 and 1:2, UK 1:1 and 1:2, Netherlands 1:3 France 1:4, Korea 1:8, USA 1:12. However there are two known structured experiments which have been conducted to reach well established sea-time remission ratios.

Firstly in Norway in 1987 a scheme was designed that equalled 6 weeks engine lab plus 3 weeks engine room simulator training with 12 months sea time in order to achieve the second engineers certification [33]. This was in a time of shortage of 2nd engineers and the traditional 18 month sea service was considered to be suitable for revision.

Secondly a study was done in Netherlands [34] involving 2 groups of students whereby the first group received one week of simulator training after their theoretical education. The other group sailed their initial year of sea-time after their theoretical schooling. Both groups were then compared with each other in the experiment. This resulted in the following statement of comparative issues:

- 40 hours(5 days) sim-time = 30 days sea-time achieving 50% performance level
- 80 hours(10 days) sim-time = 60 days sea-time achieving 76% performance level
- 120 hours(15 days) sim-time = 90 days sea-time achieving 83% performance level.

However as the 95% confidence intervals were found to have a considerable range the minimum values were taken as the measure for the remission ratio. In practice this resulted in a remission of 30 days of sea-time to be replaced by 10 days (or 80 hours) of simulator training. Further increasing the simulator training duration to 15 days (or 120 hours) narrowed down the confidence intervals also considerably, leading to a more uniform performance level by all students.
Based on these findings the Dutch government submitted a statement to the IMO STCW.2/Circ.7 8 March 2000, as equivalent arrangement accepted under Article IX that, of the initial sea-time requirements as stated in STCW II/1 and III/1, 5 days of full mission simulator training will be awarded with 15 days of seagoing service, 10 days with 30 days of seagoing service and 15 days with 60 days of seagoing service. This has now been in practice for a number of years in the Dutch MET systems to seemingly full satisfaction. Although hard proof is always disputable, the Netherlands experiences seem to justify the increased use of simulators and the relaxation of required initial sea-time, as no evident increase in accidents, casualties or errors seems to have taken place on Dutch flagged vessels, or has involved Dutch trained seafarers.

2.6.5 Instructor requirements

A teaching tool is as good as the instructor using it. The root of the quality assurance of a process lies with those who teach others to perform in the loop of that process. Furthermore with the revision of the STCW convention more emphasis is being put on the qualifications of simulator instructors.

- ***General knowledge.***

The influence an instructor has on the training effectiveness should not be underestimated. Especially in sessions with older, experienced trainees it is found that the impact of the correct type of instructor and his/her attitude towards the trainees is of vital importance. Ideally an instructor should have at least the same general knowledge as the trainees have or are expected to have upon finalization of the course. This means that for instance an engineer training course should be done by an instructor possessing the same or higher engineer qualifications as the trainees.

- ***Subject matter related knowledge.***

As stated before ideally the instructor should hold at least the same qualifications as the trainees he/she is supposed to instruct. Not only will it add to his/her prestige, it will often prove essential to get the message across properly, with all the small nuances involved when the training course reaches a higher level of sophistication. Of course this will not always be possible. The higher or more specialized the training, the more difficult it becomes to have instructors holding the same diplomas as the trainees. In general however one can say that, without any sea-going experience it will be hard to cope with all the routine items of the trade or the jargon when having to train seafarers in, e.g., a new type of ship handling bridge layout or cargo handling system.

- ***Experience***

There is a great importance for the simulator instructor to a have thorough background or experience in teaching or instructional techniques. It will be just as necessary to have the skills to organize a lesson, transfer knowledge and ideas, relate to people in simulator training as it is done in training systems using other teaching tools. The required experience may have been gained in various ways:

- proper pedagogical teacher training at a regular teacher training institute,
- a simulator instructor course, possibly upon installation of the system,
- previous instructor experience, ideally using simulators.

Once the matter of instructor experience has been solved, the presence of certain skills should be investigated to ensure the selected candidates are suitable for the instructor task.

The debriefing activities offer another area of possible mishap. At the cadet level a lecture type of debriefing can be used. Experienced adult trainees require a different approach and here a debriefing discussion should be considered. Some trainees will probably need a bit more debriefing and comments than others. As in any public address it is essential to communicate remarks or criticism in the appropriate way. The trainees background, culture, personality, age, peer group all have influence on what is appropriate and how sensitivities should be dealt with.

- ***Motivation.***

The enthusiasm of the instructor for the training programme, exercises and equipment are one crucial element in the success of a course. The instructor should genuinely recognize the importance of the training and convey this to the students. An instructor who does not believe in the instruction can hardly be taken seriously by the trainees [35]. A word of caution is relevant here, to instructors becoming over-experienced. This could result in training material or exercises becoming so familiar that the importance for the trainees, who experience the simulator for the first time, is completely disregarded. Even worse is the situation whereby the over-experience leads to demotivation of the instructor as there is no more real challenge in the task to be performed. This will immediately have a negative effect on the training efforts and the students' success in the simulator course.

As simulator equipment implies considerable financial investment, it would be expected that in the case of simulator instructors some form of evaluation of staff would be applied. Instructor related evaluation items could then be:

- ability to develop an exercise,
- ability to conduct a training session,
- ability to transfer concepts and knowledge,
- ability to utilize various teaching techniques effectively,
- ability to monitor and supervise trainees,
- ability to provide proper briefing and debriefing information,
- ability to identify students requiring extra guidance,
- ability to motivate the trainees,
- ability to create the right learning atmosphere,
- ability to perform training sessions in a professional way.

Where STCW95 puts great emphasis on the quality assurance of training and on the qualifications of instructors, it gives very little concrete information on what is actually intended and how this shall be achieved. For QA matters reference is made to existing systems like ISO 9000 series which should be adapted to education in general and maritime education in particular. However as to the qualifications of instructors only the following rather vague phrases are given:

- ***Annex: Regulation I/6 Training and assessment***

2. Those responsible for training and assessment of competence of seafarers are appropriately qualified in accordance with section A-I/6 of the STCW Code

- ***Code Part A: Section A-I/6: Training and assessment***

3. Each party shall ensure that instructors, supervisors and assessors are appropriately qualified for the particular types and levels of training or assessment of competence of seafarers, either onboard or ashore, as required under the Convention in accordance with the provisions of this section. (It is indicated here that the IMO Model Course 6.09 Training Course for Instructors can be of assistance in preparing for such qualifications).

- ***Code Part B: Section B-I/6 Guidance regarding training and assessment***
    1. *Eachpartyshouldensurethatinstructors and assessors are appropriatelyqualified and experiencedforthe particular types and levels of training orassessment of competence of seafarers, as requiredundertheConvention in accordancewiththeguidelines of thissection.*

As stated, it will not be possible to develop proper criteria and guidelines for the training and/or qualifications of neither instructors nor, more specifically simulator instructors, from these very limited indications. It will therefore depend heavily on the knowledge and expertise of the training institute and of the individuals how the level of instructional staff will finally be. That means that, although a first attempt has been made by IMO to regulate and quality control the teachers and instructors, there can and will, still be considerable differences between the various institutes and thus the courses performed there.

3. Design a revalidation model course structure

3.1 STCW relevance

Having identified the main aspects in application of maritime simulation for the training and assessment of seafarers, it is now of interest to make the inventory of which competences can be demonstrated by approved simulator training, according to STCW 95/2010 code Part A competence tables.

In the CoC Revalidation Model Course structure these are the competences that will no longer require theoretical, written or oral examinations, but can be practically demonstrated by means of simulation, identification of which is one of the objectives of this project.

A general division is usually made between the deck and engine department related subjects as these are the disciplines in which seafarers are employed. However the function area division used in STCW 95/2010 is a logical practical subdivision to base identification of competences on.
Nevertheless within the scope of this project it has been explicitly agreed that only the competences relating to the deck department as described in STCW Code Part A Chapter II, shall be taken into consideration.
The STCW function Group in Chapter II are as follows:

- Navigation
- Cargohandling and stowage
- Controlling ship operations
- Maintenace and repair

The described competences are also divided per function level: support, operational, management

Fig. 7. An example of above criteria shown in the competence tables in STCW Code Part A-II/2.

Table A-II/2
Specification of minimum standard of competence for masters and chief mates on ships of 500 gross tonnage or more

Function: Navigation at the management level

Column 1	Column 2	Column 3	Column 4
Competence	**Knowledge, understanding and proficiency**	**Methods for demonstrating competence**	**Criteria for evaluating competence**
Plan a voyage and conduct navigation	Voyage planning and navigation for all conditions by acceptable methods of plotting ocean tracks, taking into account, e.g.: .1 restricted waters .2 meteorological conditions .3 ice .4 restricted visibility .5 traffic separation schemes .6 areas of extensive tidal effects Routeing in accordance with the General Principles on Ships' Routeing Reporting in accordance with the Guidelines and Criteria for Ship Reporting Systems	Examination and assessment of evidence obtained from one or more of the following: .1 approved in-service experience .2 approved simulator training, where appropriate .3 approved laboratory equipment training using: chart catalogues, charts, nautical publications and ship particulars	The equipment, charts and nautical publications required for the voyage are enumerated and appropriate to the safe conduct of the voyage. The reasons for the planned route are supported by facts and statistical data obtained from relevant sources and publications. Positions, courses, distances and time calculations are correct within accepted accuracy standards for navigational equipment. All potential navigational hazards are accurately identified.

3.2 Listed competences Chapter II assessable by simulator

In the description of the project it has been indicated that due to the limited time and budget available, only those competences relating to ships bridge simulators will be considered for the model course scenario development and testing.

We found that 26 competences out of all the ones described in column 1 of tables A-II/1 and A-II/2 of STCW 95/2010 (corresponding to the operational and management levels respectively) may be evaluated by using a simulator. They are the following:

At **OPERATIONAL level:**

Navigation:

- Plan and conduct a passage and determine position (1)
- Maintain a safe navigational watch (2)
- Use of radar and ARPA to maintain safety of navigation (3)
- Use of ECDIS to maintain the safety of navigation (4)
- Respond to emergencies (5)
- Respond to distress signals at sea (6)
- Transmit and receive information by visual signaling (7)
- Maneuver the ship (8)

Cargo handling and stowage:

- Monitor the loading, stowage, securing and unloading of cargoes and their care during the voyage (9)
- Inspect and report defects and damage to cargo spaces, hatch covers and ballast tanks (10)

Controlling the operation of the ship care for persons on board:

- Maintain seaworthiness of the ship (11)

In table A-II/1, there are a total of 19 competences for the operational level, and 11 of them may be evaluated by simulator; that is the 57.9%.

More specifically: the Navigation section (operational level) consists of 9 competences, and 8 of them may be evaluated by simulator, representing the 88.9%; the Cargo handling and stowage section (operational level) consists of 2 competences, both evaluated by simulation, that is, the 100%, and the Controlling the operation of the ship care for persons on board section (operational level) has 8 competences, but only 1 may be assessed by simulator, that is the 12.5%.

At **MANAGEMENT level**:

Navigation:

- Plan a voyage and conduct navigation (12)
- Determine position and the accuracy of resultant position fix by any means (13)
- Determine and allow for compass errors (14)
- Co-ordinate search and rescue operations (15)
- Establish watch keeping arrangements and procedures (16)
- Maintain safe navigation through the use of navigation equipment and systems to assist command decision-making (17)
- Maintain the safety of navigation through the use of ECDIS and associated navigation system to assist command decision-making (18)
- Maneuver and handle a ship in all conditions (19)

- Operate remote controls of propulsion plant and engineering systems and services (20)

Cargo handling and stowage:
- Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes (21)
- Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action (22)
- Carriage of dangerous cargoes (23)

Controlling the operation of the ship care for persons on board:
- Control trim, stability and stress (24)
- Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea and the protection of the marine environment (25)
- Use leadership and managerial skills (26)

In table A-II/2, there are a total of 20 competences for the management level, and 15 of them may be evaluated by simulator; that is the 75%.

More specifically: the *Navigation section (management level)* consists of 11 competences, and 9 of them may be evaluated by simulator, representing the 81.8%; the *Cargo handling and stowage section (management level)* consists of 3 competences, all of them evaluable by simulation, that is, the 100%, and the *Controlling the operation of the ship care for persons on board section (management level)* has 6 competences, and 3 may be assessed by simulator, that is the 50%.

Considering the two levels being analyzed (management and operational) there are a total of 39 competences, and 26 may be evaluated by using a simulator; that is the 66.7%, i.e.: two thirds. Also, note that the *Cargo handling and stowage, at its two levels section (management and operational)*, is a 100% evaluable by simulator

The legal basis for evaluating only with simulator is found in column 3 of the tables provided, where it says that for all these cases:

Column 3
Methods for demonstrating competences
Examination and assessment of evidence obtained from one or more of the following competences: (...)
In all cases, one of the modalities is: *approved simulator training, where appropriate*

Also, for competence *(3): Use of radar and ARPA to maintain safety of navigation*, the evaluation with simulator is compulsory, column 3 of table A-I specifies: *Assessment of evidence obtained from approved radar simulator and ARPA simulator plus in-service experience.*

And for competence *(17): Maintain safe navigation through the use of navigation equipment and systems to assist command decision-making*, column 3 of table A-II specifies:
Examination and assessment of evidence obtained from one or more of the following: (...); i.e.: an ARPA simulator and other modality for the other navigational equipment, being one of them an *approved simulator training, where appropriate*.

Therefore, to evaluate the radar and ARPA competences, it is mandatory the use of a simulator.

Finally, some competences, although they may be evaluated by simulator, also require some supporting material:

- For competences (1), (12) and (13), this supporting material consists of: chart catalogues, charts, nautical publications, radio navigational warnings, nautical instruments, a sextant, an azimuth mirror and ship particulars. Other required equipment may be simulated: navigation equipment, echo-sounding equipment and compass.
- For competences (4) and (18), an ECDIS programme on computer useful for implementation on bridge simulator is required.
- For competences (11), (21) and (22), in any modality, the use of stability, trim and stress tables, diagrams and stress-calculating equipment is required.

We assume that the training centres have the required ECDIS programme for competences (4) and (18). Also, the tables for competences (11), (21) and (22) are incorporated in the simulator software. Then, if it is necessary to refer to them or to make a manual calculation, they may be printed.

3.3 Knowledge, understanding and proficiency of the column 2 of Tables A-II/1-2

In column 1 of tables A-II/1 and A-II/2, the competences to remember (or update) and to assess are mentioned; but in column 2, the knowledge to acquire is specified. Therefore, of the twenty-six competences evaluable with simulator, not all knowledge of each of these competences is assessable by simulator.For example: with respect to competence (1): Plan and conduct a passage and determine position, the first knowledge is Celestial navigation: Ability to determine the ship's position using celestial bodies.

Simulation is a realistic imitation, in real time, of any ship handling, radar and navigation, propulsion, cargo/ballast or other ship-system incorporating an interface suitable for interactive use by the trainee or candidate either within or outside of the operating environment, and complying with the performance standards prescribed in the relevant parts of this section of the STCW code.
That is: a simulator is provided to simulate equipment that can be found on board, taking into account the impact of external events, but it is not conceived to simulate external phenomena alone. For example, the state of the sea is a factor to consider in the use of the radar/ARPA, but certain specific effects of this factor, such as the movement of the ship, are not simulated.

On the other hand, there are certain skills that are not strictly evaluated by simulation, but may require the use additional material.

Such is the case of the following knowledge area of competence (1):
Thorough knowledge of charts and publications, such as sailing directions, tide tables, notices to mariners, navigational warnings and information on routeing, and capacity to use them.
Although this knowledge must not necessarily be updated and evaluated with a simulator, it is a knowledge which does not require a theoretical lesson for its updating and evaluation, but a practical session, which can be carried out with a simulator, and not only that, it may also be done simultaneously with other knowledge that require strict evaluation with a simulator.

There is knowledge to be refreshed and evaluated theoretically, but without extensive development.
Examples of such knowledge could be the following:
From competence (1), the point: Knowledge of the principles of magnetic and gyro compass; and from competence (2), the point: Thorough knowledge of content, application and intent of the International Regulations for Preventing Collisions at Sea, 1972, as amended [36].
Both points are previous to others points that are strictly evaluable with simulator. So, these previous points may be developed before the training with simulator using some additional material. Thus, for example, it can be explained with the help of a power point presentation or a video tutorial, and can be assessed with a self-test after the presentation.

Therefore, this knowledge may also be updated and evaluated through additional material. In other words, although these points cannot be developed or evaluated with the training tool (simulator), they must be included in the training program.

In short, the teaching and assessment of certain knowledge can be carried out:

i) by simulator; for example: for competence (2), the point: the use of information from navigational equipment for maintaining a safe navigational watch;
ii) by supporting material; for example: for competence (1), the point: knowledge of the principles of magnetic and gyro-compasses;
iii) by other modality, if the specific training tools cannot simulate the required conditions; for example: for competence (1), the point: Ability to use celestial bodies to determine the ship's position.

But we have seen that the first two options can be assessed by simulator, and only the third one, which depends on the simulator, should be excluded.

3.4 Development

This section aims to determine the knowledge required for each of the 26 competences which are evaluated by simulation. That is, a more detailed selection will be provided based on the specific knowledge that students need to refresh or update, and for which they must demonstrate their understanding and proficiency. This selection will also be the point of departure for the future development of specific tasks for each of the knowledge points in column 2.
Below, there is a list with the specific knowledge areas for each competence, the type of simulator to be used, according to the list in section 2.2. If a knowledge aspect is evaluable by using additional material apart from the simulator, rather than mentioning the type of simulator, this is indicated as SM (Supporting Material). 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".

OPERATIONAL LEVEL. TABLE A-II/1: competences from (1) to (11)

Competence (1): Plan and conduct a passage and determine position. Skills/knowledge areas:

- *Celestial navigation*
  (a) Ability to use celestial bodies to determine the ship's position
  It depends on the simulator; a priori, with SM in a whole session
- *Terrestrial and coastal navigation*
  (a) Ability to determine the ship's position by use of:
  1. landmarks **NAV or NAV/RAD**
  2. aids to navigation, including light houses, beacons and buoys **NAV or NAV/RAD**
  3. dead reckoning, taking into account winds tides, currents and estimated speed
  With SM during the briefing or debriefing
  (b) 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
  With SM during simulator training, and NAV or NAV/RAD with ECDIS application
- *Electronic systems of position fixing and navigation*
  (a) Ability to determine the ship's position by using electronic navigational aids **NAV/RAD**
- *Echo-sounders*
  (a) Ability to operate the equipment and apply the information correctly
  NAV or NAV/RAD
- *Compass – magnetic and gyro*
  (a) Knowledge of the principles of magnetic and gyro-compasses
  With SM during the briefing

(b) Ability to determine errors of magnetic compasses and gyro-compasses, using celestial and terrestrial means, and to allow for such errors **NAV o NAV/RAD**

- *Steering control system*
  (a) Knowledge of steering control systems, operational procedures and changeover from manual to automatic control and vice versa. Adjustment of controls for optimum performance **NAV o NAV/RAD**
- *Meteorology*
  (a) Ability to use and interpret information obtained from shipborne meteorological instruments
  With virtual meteorological instruments during the simulator training
  (b) Knowledge of the characteristics of the various weather systems, reporting procedures and recording systems **With SM during the briefing**
  (c) Ability to apply the meteorological information available
  With a virtual weather data receiver during the simulator training

Competence (2): Maintain a safe navigational watch. Skills/knowledge areas:

- *Watchkeeping*
  (a) Thorough knowledge of the content of the International Regulations for Preventing Collisions at Sea, 1972, as amended
  With SM in a whole session and during a debriefing
  (b) Thorough knowledge of the Principles to be observed in keeping a navigational watch **With SM during the briefing**
  (c) The use of routeing in accordance with the General Provisions on Ship's Routeing[37] **With SM during the briefing or debriefing**
  (d) The use of information from navigational equipment for maintaining a safe navigational watch **NAV/RAD**
  (e) Knowledge of blind pilotage techniques **NAV/RAD**
  (f) The use of reporting of accordance with the General Principles for Ship Reporting Systems [38] and the VTS procedures **COM and VTS**
- *Bridge resource management*
  (a) Knowledge of bridge resource management principles, including:
  1. allocation, assignment, and prioritization of resources
  2. effective communication
  3. assertiveness and leadership
  4. obtaining and maintaining situational awareness
  5. consideration of team experience

  During the debriefing

  These skills are not strictly evaluated by simulation, but may be evaluated indirectly, observing the response of the trainee being evaluated, either in real time or using recordings (such as video) for the analysis.

Competence (3): Use of radar and ARPA to maintain the safety of navigation.
Skills/knowledge areas:

- *Radar navigation*
  (a) Knowledge of the fundamentals of radar and automatic radar plotting aids
  WithSM during the briefing
  (b) Ability to operate and to interpret and analyse information obtained from radar, including the following:
  1. factors affecting performance and accuracy **RAD or NAV/RAD**
  2. setting up and maintaining displays **RAD or NAV/RAD**

3. detection of misrepresentation of information, false echoes, sea return, etc., beacons and SARTs **RAD or NAV/RAD**

(c) Use, including:
1. range and bearing; course and speed of other ships; time and distance of closest approach of crossing, meeting overtaking ships **RAD or NAV/RAD**
2. identification of critical echoes; detecting course and speed changes of other ship; effect of changes on ship's own course and speed or both **RAD or NAV/RAD**
3. application of the International Regulations for Preventing Collisions at Sea, 1972, as amended **RAD or NAV/RAD**
4. plotting techniques and relative – and true – motion concepts **RAD or NAV/RAD**
5. parallel indexing **RAD or NAV/RAD**

(d) Principal types of ARPA, their display characteristics, performance standards and the dangers of over-reliance on ARPA **With SM during the briefing**

(e) Ability to operate, interpret and analyse information obtained from ARPA, including:
1. system performance and accuracy, tracking capabilities and limitations, and processing delays **RAD or NAV/RAD with ARPA application**
2. use of operational warnings and system tests **RAD or NAV/RAD with ARPA application**
3. methods of target acquisition and their limitations **RAD or NAV/RAD and SM**
4. true and relative vectors, graphic representation of target information and danger areas **RAD or NAV/RAD with ARPA application**
5. deriving and analyzing information, critical echoes, exclusion areas and trial maneuvers **RAD or NAV/RAD with ARPA application**

Competence (4): Use of ECDIS to maintain the safety of navigation.
Note: Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. These limitations shall be reflected in the endorsements issued to the seafarer concerned.
Respect to this note, next to the revalidation course, an additional ECDIS course should be offered to the student.
Skills/knowledge areas:

- *Navigation using ECDIS*

(a) Knowledge of the capability and limitations of ECDIS operations, including:
1. thorough understanding of Electronic Navigational Chart (ENC) data, data accuracy, presentation rules, display options and other chart data formats **With SM during the briefing**
2. the danger of over-reliance**With SM during the briefing**
3. familiarity with the functions of ECDIS required by performance standards in force **With SM during the briefing**

(b) Proficiency in operation, interpretation, and analysis of information obtained from ECDIS, including:
1. use of functions that are integrated with other navigation systems in various installations, including proper functioning and adjustment to desired settings **NAV/RAD with ECDIS application**
2. safe monitoring and adjustment of information, including own position, sea area display, mode and orientation, chart data displayed, route monitoring, user-created information layers, contacts (when interfaced with ASIS and/or radar tracking) and radar overlay functions (when interfaced) **NAV/RAD with ECDIS application**

3. confirmation of vessel position by alternative means **NAV or NAV/RAD**
4. efficient use of settings to ensure conformance to operational procedures, including alarm parameters for anti-grounding, proximity to contacts and special areas, completeness of chart data and chart update status, and backup arrangements **NAV/RAD with ECDIS application**
5. adjustment of settings and values to suit the present conditions **NAV/RAD with ECDIS application**
6. situational awareness while using ECDIS including safe water and proximity of hazards, set and drift, chart data and scale selection, suitability of route, contact detection and management, and integrity of sensors **NAV/RAD with ECDIS application**

Competence (5): Respond to emergencies. Skills/knowledge areas:

- *Emergency procedures*

(a) Precautions for the protection and safety of passengers in emergency situations **With SM during the briefing, or in the advanced survival course**

(b) Initial actions to be taken following a collision or a grounding; initial damage assessment and control **SPI, CAR and/or BAL where appropriate**

(c) Appreciation of the procedures to be followed for recuing persons from the sea, assisting a ship in distress, responding to emergencies which arise in port **SAR**

Competence (6): Respond to a distress signal at sea. Skills/knowledge areas:

- *Search and rescue*

(a) Knowledge of the contents of the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual [39] and IMO Standard Marine Communication Phrases (SMCP) [40]**SAR and COM where appropriate**

Competence (7): Transmit and receive information by visual signalling. Skills/knowledge areas:

- *Visual signalling*

(a) Ability to use the International Code of Signals **SM and COM where appropriate, both during the simulation training**

(b) Ability to transmit and receive, by Morse light, distress signal SOS as specified in Annex IV of the International Regulations for Preventing Collisions at Sea, 1972, as amended, in appendix 1 of the International Code of Signals, and visual signaling of single-letter signals as also specified in the International Code of Signals **SAR and COM where appropriate, during the simulator training**
Moreover, the simulator can be capable of visual signals for instance with flags.

Competence (8): Ship maneuvering and handling. Skills/knowledge areas:

- *Ship maneuvering and handling*

(a) Knowledge of:

1. the effect of deadweight, draught, trim, speed and under-keel clearance on turning circles and stopping distances **NAV**
2. the effects of wind and current on ship handling **NAV**
3. maneuvers and procedures for rescuing a person overboard **NAV**
4. squat, shallow-water and similar effects **NAV**
5. proper procedures for anchoring and mooring **NAV and SM, both during the simulator training**

Competence (9): Monitor the loading, stowage securing, care during the voyage and the unloading of cargoes. Skills/knowledge areas:

- *Cargo handling, stowage and securing*

(a) Knowledge of the effect of cargo, including heavy lifts, on the seaworthiness and stability of the ship **With SM during the briefing and debriefing**
(b) 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
CAR and CRA where appropriate, and SM during the simulator training
(c) Ability to establish and maintain effective communications during loading and unloading
During the debriefing, and COM where appropriate
These skills are not strictly evaluated by simulation, but may be evaluated indirectly, observing the response of the trainee being evaluated, either in real time or using recordings (such as video) for the analysis.

Competence (10): Inspect and report defects and damage to cargo spaces, hatch covers and ballast tanks. Skills/knowledge areas:
(a) Knowledge* and ability to explain where to look for damage and defects most commonly encountered due to:
1. loading and unloading operations
2. corrosion
3. severe weather conditions
4. Ability to state which parts of the ship shall be inspected each time in order to cover all parts within a given period of time
(b) Identify those elements of the ship structure which are critical to the safety of the ship
(c) State the causes of corrosion in cargo spaces and ballast tanks and how corrosion can be identified and prevented
(d) Knowledge of procedures on how inspections shall be carried out
(e) Ability to explain how to ensure reliable detection of defects and damages
(f) Understanding of the purpose of the "enhanced survey program"
*It should be understood that deck officers need not be qualified in the survey of the ships.
It depends on the simulator; a priori, with SM during the briefing. A theoretical test or exam is more preferable.
If this competence is assessed by simulator, point (f) may be explained with SM during the briefing and debriefing.

Competence (11): Maintain seaworthiness of the ship. Skills/knowledge areas:
- *Ship stability*
(a) Working knowledge and application of stability, trim and stress tables, diagrams and stress-calculating equipment **SM, CAR and BAL**
(b) Understanding of fundamental actions to be taken in the event of partial loss of intact buoyancy
CAR and BAL, understanding that comprehension may be demonstrated by simulated action.
(c) Understanding of the fundamentals of watertight integrity
With SM during the briefing
- *Ship construction*
(a) General knowledge of the principal structural members of a ship and the proper names for the various parts
With SM during half session

MANAGEMENT LEVEL. Table A-II/2: competences from (12) to (26)

Competence (12): Plan a voyage and conduct navigation. Skills/knowledge areas:

(a) Voyage planning and navigation for all conditions by acceptable methods of plotting ocean tracks, taking into account, e.g.:
   1. restricted waters
   2. meteorological conditions
   3. ice
   4. restricted visibility
   5. traffic separation schemes
   6. vessel traffic services (VTS) areas
   7. areas of extensive tidal effects

   With SM during the briefing and debriefing, and NAV with ECDIS application

(b) Routeing in accordance with the General Provisions on Ship's Routeing
   With SM during the briefing and debriefing, and NAV with ECDIS application

(c) Reporting in accordance with the General principles for Ship Reporting Systems and with VTS procedures **NAV and VTS**

Competence (13): Determine position and the accuracy of resultant position fix by any means. Skills/knowledge areas:

(a) Position determination in all conditions:
   1. by celestial observations **It depends on the simulator**
   2. by terrestrial observations, including the ability to use appropriate charts, notices to mariners and other publications to assess the accuracy of the resulting position fix
      NAV, and SM during briefing (for plan a passage) and during the simulator training (for conduct a passage and determine position)
   3. using modern electronic navigation aids, with specific knowledge of their operating principles, limitations, sources of error, detection of misrepresentation of information and methods of correction to obtain accurate position fix
      NAV with ECDIS application, and SM during the briefing and debreifing

Competence (14): Determine and allow for compass errors. Skills/knowledge areas:

(a) Ability to determine and allow for errors of the magnetic compasses and gyro-compasses
   NAV, and SM during the briefing and debriefing

(b) Knowledge of the principles of magnetic and gyro-compasses
   With SM during the briefing

(c) An understanding of systems under the control of the master gyro and a knowledge of the operation and care of the main types of gyro-compass
   NAV, and SM during the briefing and debriefing

Competence (15): Coordinate search and rescue operations. Skills/knowledge areas:

(a) A thorough knowledge of and ability to apply the procedures described in the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual
   NAV; SAR and COM where appropriate, and SM during the briefing and debriefing

Competence (16): Establish watchkeeping arrangements and procedures. Skills/knowledge points:

(a) Thorough knowledge of content, application and intent of the International Regulations for Preventing Collisions at Sea, 1972, as amended
   NAV, and SM during the briefing and debriefing

(b) Thorough knowledge of the content, application and intent of the Principles to be observed in keeping a navigational watch
   NAV, and SM during the briefing and debriefing

Competence (17): Maintain safe navigation through the use of information from navigation equipment and systems to assist in command decision making
Skills/knowledge areas:

(a) An appreciation of system errors and thorough understanding of the operational aspects of navigational systems
NAV/RAD with ARPA application and SM, both during the simulation training
(b) Blind pilotage planning
NAV/RAD with ARPA application and SM, both during the simulation training
(c) Evaluation of navigational information derived from all sources, including radar and ARPA, in order to make and implement command decisions for collision avoidance and for directing the safe navigation of the ship
NAV/RAD with ARPA application and SM, both during the simulation training
(d) The interrelationship and optimum use of all navigational data available for conducting navigation
NAV/RAD with ARPA application; SM during the simulation, and COM

Competence (18): Maintain the safety of navigation through the use of ECDIS and associated navigations system to assist in command decisions making
Note: Training and assessment in the use of ECDIS is not required for those who serve exclusively on ships not fitted with ECDIS. These limitations shall be reflected in the endorsements issued to the seafarer concerned. Respect to this note, next to the revalidation course, an additional ECDIS course should be offered to the student.
Skills/knowledge areas:

(a) Management of operational procedures, system files and data, including:
1. manage procurement, licensing and updating of chart data and system software to conform the established procedure **With SM during the briefing**
2. system and information updating, including the ability to update ECDIS system version in accordance with vendor's product development
NAV/RAD with ECDIS application
3. create and maintain system configuration and backup files
NAV/RAD with ECDIS application
4. create and maintain log files in accordance with established procedures
NAV/RAD with ECDIS application
5. create and maintain route plan files in accordance with established procedures
NAV/RAD with ECDIS application
6. use ECDIS log-book and track history functions for inspection of system functions, alarm settings and user responses **NAV/RAD with ECDIS application**

(b) Use ECDIS playback functionality for passage review, route planning and review of system functions **NAV/RAD with ECDIS application**

Competence (19): Manoeuver and handle a ship in all conditions. Skills/knowledge areas:

(a) Manoeuvering and handling a ship in all conditions, including:
1. manoeuvers when approaching pilot stations and embarking or disembarking pilots, with due regard to weather, tide, headreach and stopping distances
NAV and COM
2. handling a ship in rivers, estuaries and restricted Waters, considering the effects of current, wind and restricted water on helm response **NAV and/or SHIP**
3. application of constant-rate-of-turn techniques **NAV and/or SHIP**
4. manoevering in shallow water, including the reduction in under-keel clearance caused by squat, rolling and pitching **NAV and/or SHIP**

5. interaction between passing ships and between own ship and nearby banks (canal effect) **NAV and/or SHIP**
6. berthing and unbearthing under various conditions of wind, tide and current with and without tugs **NAV and/or SHIP**
7. ship and tug interaction **NAV and/or SHIP, and COM where appropriate**
8. use of the propulsion and manouvering systems **NAV and/or SHIP**
9. use of anchorage; anchoring with one or two anchors in limited anchorages and factors involved in determining the length of anchor cable to be used
   NAV and/or SHIP, and SM (explanations, and charts and nautical publications), both during the simulation training
10. dragging anchor; cleaning fouled anchors **NAV and/or SHIP**
11. dry-docking, both with and without damage **NAV and/or SHIP and BAL**
12. management and handling of ships in heavy weather, including assisting a ship or aircraft in distress; towing operations; means of keeping an unmanageable ship out of trough of the sea, lessening drift and use of oil **NAV and/or SHIP**
13. precautions in manoeuvering when launching rescue boats or survival crafts in bad weather
    NAV and/or SHIP, and SM during the debriefing (may be in the briefing or debriefing)
    Manoeuver is evaluable in the bridge (course and speed appropriate), but not on deck (launching boats). Notwithstanding, the launching procedures can be explained during the briefing or debriefing.
14. methods of taking survivors on board from rescue boats and survival craft
    NAV and/or SHIP, and SM during the debriefing (may be in the briefing or debriefing)
    Manoeuver is evaluable in the bridge (course and speed appropriate), but not on deck (recuperation of boats). Notwithstanding, the recuperation procedures can be explained during the briefing or debriefing.
15. ability to determine the manovering and propulsion characteristics of common types of ships, with special reference to stopping distances and turning circles at various draughts and speeds **NAV and/or SHIP**
16. importance of navigating at reduced speed to avoid damage caused by own ship's bow wave and stern wave **NAV and/or SHIP**
17. practical measures to be taken when navigating in or near ice or in conditions of ice accumulation on board **NAV and/or SHIP**
18. use of, and manoeuvering in and near, traffic separation schemes and in vessel traffic service (VTS) areas [41]
    NAV/RAD, VTS, SM or ECDIS application, and COM where appropriate

Competence (20): Operate remote controls of propulsion plant and engineering systems and services. Skills/knowledge areas:

(a) Operating principles of marine power plants **SM during the briefing**
(b) Ships' auxiliary machinery **SHIP, CAR, BAL, and SM during the briefing**
(c) General knowledge of marine engineering terms **SM during the briefing**

Competence (21): Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes. Skills/knowledge areas:

(a) knowledge of and ability to apply relevant international regulations, codes and standards concerning the safe handling, stowage, securing and transport of cargoes
    With SM during the briefing
(b) knowledge of the effect of cargoes and cargo operations on trim and stability

SHIP, CAR and BAL

(c) Use of stability and trim diagrams and stress-calculating equipment, including automatic data-based (ADB) equipment, and knowledge of loading cargoes and ballasting in order to keep hull stress within acceptable limits
SHIP, CAR and BAL (diagrams are introduced in the simulator programme)

(d) Stowage and securing of cargoes on board ships, including cargo-handling gear and securing and lashing equipment
With SM during the briefing, and SHIP and CAR

(e) Loading and unloading operations, with special regard to the transport of cargoes identified in the Code of Safe Practices for Cargo Stowage and Securing
CAR, BAL where appropriate, and SM during the simulation

(f) General knowledge of tankers and tanker operations
With SM during the briefing and debriefing, and CAR and BAL

(g) Knowledge of the operational and design limitations of bulk carriers
With SM during the briefing, and CAR and BAL

(h) Ability to establish procedures for safe cargo handling in accordance with the provisions of the relevant instruments such as IMDG Code, IMSBC Code, MARPOL 73/78 Annexes III and V and other relevant information
With SM during the briefing and debriefing, and CAR

(i) Ability to explain the basic principles for establishing effective communications and improving working relationship between ship and terminal personnel
With SM during the briefing and debriefing, and CAR and COM

Competence (22): Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action:

(a) Knowledge of the limitations on strength of the vital construction parts of a standard bulk carrier and ability to interpret given figures for bending moments and shear forces. **With SM during the briefing, and a simulation depending on the simulator**

(b) Ability to explain how to avoid the detrimental effects of corrosion, fatigue and inadequate cargo handling on bulk carriers
With SM during the briefing, and a simulation depending on the simulator

Competence (23): Carriage of dangerous goods. Skills/knowledge areas:

(a) International regulations, standards, codes and recommendations on the carriage of dangerous cargoes, including the International Maritime Dangerous Goods (IMDG) Code and the International Maritime Solid Bulk Cargoes (IMSBC) Code
With SM during the briefing

(b) Carriage of dangerous, hazardous and harmful cargoes; precautions during loading and unloading and care during the voyage.
It depends on the simulator. An example could be loading a container ship with some containers with dangerous goods

Competence (24): Control trim, stability and stress. Skills/knowledge points:

(a) Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability

(b) Knowledge of the effect on trim and stability of a ship in the event of damage to and consequent flooding of a compartment and countermeasures to be taken

(c) Knowledge of IMO recommendations concerning ship stability

With SM during the briefing and debriefing, and CAR and BAL, understanding that comprehension may be demonstrated by simulated action.

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. Skills/knowledge areas:

(a) Knowledge of international maritime law embodied in international agreements and conventions

Regard shall be paid especially to the following subjects:

1. certificates and other documents required to be carried on board ships by international conventions, how they may be obtained and their period of validity
2. responsibilities under the relevant requirements of the International Convention on Load Lines, 1966, as amended
3. responsibilities under the relevant requirements of the International Convention for the Safety of Life at Sea, 1974, as amended
4. responsibilities under the International Convention for the Prevention of Pollution from Ships, as emended
5. maritime declarations of health and the requirements of the International Health Regulations
6. responsibilities under international instruments affecting the safety of the ship, passengers, crew and cargo
7. methods and aids to prevent pollution of the marine environment by ships
8. national legislation for implementing International agreements and conventions

This competence consists of a wide knowledge of legislative requirements, which can be explained and evaluated with **SM during the briefing.** Notwithstanding**some skills may be simulated**, as for example, loading until appropriate draft, according to the International Convention on Load Lines, or discharging oily water using a virtual flow-meter according MARPOL.

Competence (26): Use of leadership and managerial skill. Skills/knowledge areas:

(a) Knowledge of shipboard personnel management and training
(b) A knowledge of related international maritime conventions and recommendations, and national legislation
(c) Ability to apply tasks and workload management, including:
    1. planning and co-ordination
    2. personnel assignment
    3. time and resource constraints
    4. prioritization
(d) Knowledge and ability to apply effective resource management:
    1. allocation, assignment, and prioritization of resources
    2. effective Communications on board and ashore
    3. decisions reflecting consideration of team experiences
    4. assertiveness and leadership, including motivation
    5. obtaining and maintaining situation awareness
(e) Knowledge and ability to apply decision-making techniques:
    1. situation and risk assessment
    2. identifying and generating options
    3. selecting course of action
    4. evaluation of outcome effectiveness
(f) Development, implementation, and overview of standard operating procedures

WithANY SIMULATOR, a specific circumstance may be simulated, so, the actions taken by the trainee may be recorded, and **his/her answer may be evaluated during the debriefing**.

3.5 Structure of the revalidation model course

It is observed that many skills/knowledge areas may be explained and evaluated in a single exercise. For example, the use of navigational equipment, such as radar, ARPA, steering control systems or ECDIS, can be assessed at the same time that the watchkeeping procedures. Therefore, for each level (operational and management), it is possible to do some long exercises for training; simulating:

- Planning a voyage (group of exercises Nr. 1)
- Watchkeeping (group of exercises Nr. 2)
- Manoeuvering (group of exercises Nr. 3)
- Cargo handling for different kinds of ships (group of exercises Nr. 4)
- Emergencies and rescue (group of exercises Nr. 5)
- Controlling the operations of the ship and care on board (group of exercises Nr. 6)

For evaluating the trainee, these exercises should be shorter, and he/she should select one from each group. Moreover, a familiarization with the simulation tools is also necessary for the trainee.

Planning voyage **and w*atchkeeping*** exercises are single but long exercises; ***manoeuvering*** exercises depend on whether the ship berths, unberths, anchors, etc., and the ***cargo handling*** exercises also depend on the kind of cargo/type of ship. The ***Emergencies and rescue***group consists of some skills/knowledge areas that need one or more exercises for each area.

Another important point involves elaborating all supporting materials (SM), and finally, determining the time required for explaining and evaluating all skills/knowledge points.

Hereunder it is attached a table of the competences evaluable in each group.

It is also important to note that the supporting materials should be exposed, and the trainee should be evaluated, before each simulator session.

Table 2. Main Structure of the course considering competences to be evaluated. Source: own

Exercise	Competences for the Operational level	Competences for the Management level
1. Familiarization		
2. Planning a voyage	(1)* (2)*	(12) (18)
3. Watchkeeping	(1) (2) (3) (4)	(13) (14) (16) (17)
4. Manoeuvering	(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)

(1)*: (1) Terrestrial and coastal navigation (b)
(2)*: (2) The use of routeing in accordance with the General Provision on Ship's Routeing (c)

Once the revalidation simulation-based model course is designed, a course book with schedules, simulator lessons and competences to train on simulation are delivered (Annex I and Annex II). The publication presented in these annexes is provided as a guidance tool of the model contents to demonstrate marine certification competence.

4. Conclusions

We believe that the main and specific objectives of this research project are achieved.

Once the revalidation simulation-based model course is designed, a course book with schedules, simulator lessons and competences to train on simulation are delivered (Annex I and Annex II). The publication presented in these annexes is provided as a guidance tool of the model contents to demonstrate marine certification competence.

These courses provide a guide for all maritime training institutes and Government requirements for the renewing of the professional certificate for officers in charge of navigation, according to STCW requirements, as revised by the 2010 Manila amendments, specifically where these apply to table A-II/1-2, knowledge, skill and understanding of all competences that may be assessed by simulation.

This course is NOT the entire programme for revalidating the professional certificate, but it is the part, which may be assessed by simulation. Therefore, it should be understood that this is a generic course which requires a complementary structure for other competences described in the tables A-II/1-2 of the STCW Code that cannot be assessed by simulation. Therefore, it is assumed that trainees undertaking this course have accomplished some additional instruction in topics such as terrestrial navigation, have at least some familiarization with visual navigation, have accomplished a period of supervised bridge watch-keeping duties, and have prior completion of basic Radar/ARPA (MC 1.07).

An important consideration is that the course is only applicable for the revalidation purpose if the Maritime Administration in a country recognizes and approves this method in the revalidation process according to their prevailing legislative procedures.

References

[1] Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW Convention), as amended, 2011 Edition, IMO

[2] IMO ISWG (1994). STW 26/Inf. 7, Sub-Committee STCW, Submitted by Consultants/ISWG, IMO.

[3] INSLC (1990*). Recommended Specifications for Radar and Navigation Simulators*. International Navigation Simulator Lecturers Conference, 1990.

[4] Assessment Testing in a FullMissionBridge Simulator, STW28/INF14, 1996, IMO.

[5] US Dept of Transportation (1991). Airplane Simulator Qualification, Advisory circular AC120-40B,29/7/1991, Federal Aviation Administration, USA

[6] IMSF CWG (1994). Draft Classification System Classification Working Group. St. John's, Canada.

[7] DNV, DetNorskeVeritas (2000, 2007, 2011). *Standard for certification of maritime simulator systems*, DNV, Høvik, Norway

[8] NRC, National Research Council (1996). Simulated Voyages; ShipBridge Simulator Models, NationalAcademy Press, Washington, DC, USA

[9] IMO Model Courses, IMO, London, UK.

[10] MNTB, Merchant Navy Training Board (1997). *Navigation and Radar Simulator Training*, MNTB, London. UK.

[11] EU 4th Framework Programme, MASSTER (1998). *Maritime Standardized Simulator Training Exercises Register*, Brussels, Belgium.

[12] Rowntree, D. (1987). *Assessing students: How shall we know them*, pp. 81-167, Kogan Page, London, UK

[13] Fletcher, S. (1992). Competence Based Assessment Techniques, Kogan Page, London

[14] MIWB, MaritiemInstituut Willem Barentsz, (2008). *Quality Handbook and Examination Guidelines*, NHL, Leeuwarden, The Netherlands

[15] McCallum, M.C. (1996).*Criterion Based Assessment of Marine Simulator Operator Performance*, Conference on Marine Simulation, Alexandria, Egypt

[16] Mager, R.F. (1984). *Measuring Instructional Results*, Kogan Page, London, UK.

[17] Reay, D.G. (1994). *Evaluating Training*, Kogan Page, London, UK.

[18] Cross, S.J. (1993). *An Evaluation Tool for Simulator Training*, Marsim93, St.John's, Canada.

[19] Cross, S.J. (1996). *Methodology for Bridge Simulator Skills Assessment*, Marsim 96, Copenhagen, Denmark.

[20] DNV, Det Norske Veritas (1996). *Rules for classification of maritime simulator centres*, DNV, Høvik, Norway.

[21] DNV, Det Norske Veritas B.V. (1995). *Certificatie van vakbekwaamheid* (Dutch), DNV BV., Rotterdam, The Netherlands.

[22] Newby, T.(1992). *Validating your training*, pp. 75-99, Kogan Page, London, UK.

[23] Kayten,P.J., King,T.A., Korosh,W.M., Miller,W.C., Kaufman,E.J., Williams, K.E. (1982).*Assessment of Simulator based training for the enhancement of cadet watch officer performance*. Caorf research study 15-8110-02. National Maritime ResearchCenter, KingspointNew York, USA

[24] Multer et al, 1983 Multer, J, D'Amico, A, Williams, K, Saxe, C (1983). *Efficiency of simulation in the acquisition of shiphandling knowledge as a function of previous experience*. Caorf Research study 52-8101-02. National Maritime ResearchCenter, KingspointNew York, USA

[25] Bjorklund,R., Rodahl,K., Robertson,B.J. Wohni,B, Otherhals,O, Overas,P. Vespestad J, Midtgard A, (1987), *Effects of Maritime Simulator Training on Performance*. Marsim 1987, Trondheim, Norway

[26] Muirhead, 1988 Muirhead, P.M.P. (1988), *The validation or Marine Simulator Training*, 5th INSLC, Launceston, Australia

[27] Muirhead, P.M.P. (1986), *Comparative study on emergency manoeuvres in real and simulated vessels*, Launceston, Australia
[28] Rooij,van 1992 Rooij, J.C.G.M.van (1992), *Simulator based training of perceptual-motor skills ITEC,* 1992, Luxembourg.
[29] Korteling, J.E. (1992), *Mogelijkheden en beperkingen van simulatoren in de rijopleiding* (in Dutch), TNO VerkeerskundeJournaal, Soesterberg, Netherlands
[30] MSA (1995), *The effectiveness and practical application of simulators as tools for training and examining seafarers*. MSA, Southampton, UK
[31] Boer, J.P.A. (1991), *Het gebruik van simulatorenvooropleiding en training: bepalendefactorenvoor de waarde van een simulator alsleermiddel.* (in Dutch), TNO-IZF, Soesterberg, Netherlands
[32] Roscoe, 1971 Roscoe, S.N. (1971), *Incremental transfer effectiveness*, Human Factors 13, USA.
[33] Tonsberg college (1987),Tonsberg Maritime College et al, (1987) Report on development project sea duty on simulator, Tonsberg, Norway.
[34] DGSM et al, TNO / MSR, (1994), *Simulator time and its seatime equivalence Rijswijk*, The Netherlands
[35] Beard, R., Hartley, J (1984).*Teaching and Learning in Higher Education*, Harper & Row Publishers, London, UK.
[36] Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREG 1972), Consolidated Edition 2003, IMO
[37] Ship's Routeing, 2010 Edition, IMO.
[38] Guidelines and Criteria for Ship Reporting Systems. Res. MSC 43(64) adopted on 9 december 1994, IMO.
[39] International Aeronautical and Maritime Search and Rescue Manual (IAMSAR Manual), 2013 Edition, IMO.
[40] Standard Marine Communication Phrases (SMCPs). MSC/Circ.794, 10 June 1997, IMO.
[41] Guidelines for vessel traffic services. Resolution A.857(20) , adopted on 27 November 1997, IMO.

Annex I

Annex I

SIMULATION-BASED MODEL COURSE (OPERATIONAL LEVEL – DECK DEPARTMENT)

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Foreword

This course has been developed by the International Association of Maritime Universities (IAMU), following the model course structure adopted by the International Maritime Organization (IMO).

Since its inception the IMO has recognized the importance of human resources to the development of the maritime industry and has given the highest priority to assisting developing countries in enhancing their maritime training capabilities through the provision or improvement of maritime training facilities at national and regional levels. IMO has also responded to the needs of developing countries for postgraduate training for senior personnel in administrations, ports, shipping companies and maritime training institutes by establishing the World Maritime University in Malmö, Sweden, in 1983.

Following the adoption of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW Code), a number of IMO Member Governments had suggested that IMO should develop model training courses to assist in the implementation of the Convention and in achieving a more rapid transfer of information and skills regarding new developments in maritime technology. IMO training advisers and consultants also subsequently determined from their visits to training establishments in developing countries that the provision of model courses could help instructors improve the quality of their existing courses and enhance their implementation of the associated Conference and IMO Assembly resolutions.

After the Manila Amendments and the intention of enhancing the training, Governments, shipowners and other parties involved in the maritime trade, have noted the necessity of a worldwide standardization for the training of seafarers, and also the advisability of the use of simulators for a more practical training. In this sense, IAMU has developed this course, trying to assess the revalidation certificates with simulation sessions whenever possible.

In addition, it was appreciated that a comprehensive set of short model courses in various fields of maritime training would supplement the instruction provided by maritime academies and allows administrators and technical specialists already employed in maritime administrations, ports and shipping companies to improve their knowledge and skills in certain specialized fields. With the generous assistance of the Government of Norway, IMO developed model courses in response to these generally identified needs and now keeps them updated through a regular revision process taking into account any amendments to the requirements prescribed in IMO instruments and any technological developments in the field.

Introduction
Purpose of the model courses

As the intention of this revalidation course is to follow the standards of the IMO model courses, IAMU also agrees with the purposes of the IMO model courses.

The purpose of this revalidation simulation-based model course is to assist maritime training institutes and their teaching staff in organizing and introducing new training courses or in enhancing, updating or supplementing existing training material where the quality and effectiveness of the training courses may thereby be improved. Only those competences relating to ships bridge simulators will be considered for the model course scenario development and testing.

It is not the intention of the model course program to present instructors with a rigid “teaching package” which they are expected to “follow blindly”. Nor is it the intention to substitute audio- visual or “programmed” material for the instructor’s presence. As in all training endeavours, the knowledge, skills and dedication of the instructor are the key components in the transfer of knowledge and skills to those being trained through IMO model course material.

Because educational systems and the cultural backgrounds of trainees in maritime subjects vary considerably from country to country, the model course material has been designed to identify the basic entry requirements and trainee target group for each course in universally applicable terms, and to specify clearly the technical content and levels of knowledge and skill necessary to meet the intent of IMO conventions and related recommendations.

Use of the model course

To use the model course the instructor should review the course plan and detailed syllabus, taking into account the information provided under the entry standards specified in the course framework. The actual level of knowledge and skills and the prior technical education of the trainees should be kept in mind during this review, and any areas within the detailed syllabus which may cause difficulties because of differences between the actual trainee entry level and that assumed by the course designer should be identified. To compensate for such differences, the instructor is expected to delete from the course, or reduce the emphasis on, items dealing with knowledge or skills already attained by the trainees. He should also identify any academic knowledge, skills or technical training which they may not have acquired.

By analyzing the detailed syllabus and the academic knowledge required to allow training in the technical area to proceed, the instructor can design an appropriate preentry course or, alternatively, insert the elements of academic knowledge required to support the technical training elements concerned at appropriate points within the technical course.

Adjustment of the course objectives, scope and content may also be necessary if in your maritime industry the trainees completing the course are to undertake duties which differ from the course objectives specified in the model course.

Within the course plan the course designers have indicated their assessment of the time that should be allotted to each learning area. However, it must be appreciated that these allocations are arbitrary and

assume that the trainees have fully met all entry requirements of the course. The instructor should therefore review these assessments and may need to re-allocate the time required to achieve each specific learning objective.

Lesson Plans

Having adjusted the course content to suit the trainee intake and any revision of the course objectives, the instructor should draw up lesson plans based on the detailed syllabus. The detailed syllabus contains specific references to the textbooks or teaching material proposed for use in the course. Where no adjustment has been found necessary in the learning objectives of the detailed syllabus, the lesson plans may simply consist of the detailed syllabus with keywords or other reminders added to assist the instructor in making his presentation of the material.

Presentation

The presentation of concepts and methodologies must be repeated in various ways until the instructor is satisfied that the trainee has attained each specified learning objective. The syllabus is laid out in learning-objective format and each objective specifies what the trainee must be able to do as the learning outcome.

Implementation

For the course to run smoothly and to be effective, considerable attention must be paid to the availability and use of:

- Properly qualified instructors
- Support staff
- Rooms and other spaces
- Main equipment: **simulators**
- Charts and nautical publications
- Other supporting material as teaching aids, such as video tutorial or power points
- Other reference material

Thorough preparation is the key to successful implementation of the course. IMO has produced "Guidance on the Implementation of IMO Model Courses," which deals with this aspect in greater detail and is included as an attachment to this course; and IAMU has also adopted this IMO Guide.

Part A: Course Framework

Scope

This course intends to provide a guide for all maritime training institutes and Government requirements for the renewing of the professional certificate for officers in charge of navigation, according to STCW requirements, as revised by the 2010 Manila amendments, specifically as these apply to table A-II/1, knowledge, skill and understanding of all competences that may be assessed by simulation.

Thus, this course is not the whole course for renewing the professional certificate for officer in charge of navigation, but it is the part which may be assessed by simulation. Therefore, it should be understood that this is a generic course which requires a structured and complementary with other competences described in the tables A-II/1 of the STCW Code that cannot be assessed by simulation.

Notwithstanding, this course intends to assess all competences of the table A-II/1 that may be evaluated by using a simulator.

Objective

Those who successfully complete this course should be able to demonstrate sufficient knowledge, skill and understanding of the competences (that can be evaluated by simulator) described in the table A-II/1 of STCW Code, as amended. This knowledge, skill and understanding should include Column 1 of Table A-II/1:

Navigation

- Plan and conduct a passage and determine position
- Maintain a safe navigational watch
- Use of radar and ARPA for a safe navigation
- Use of ECDIS for a safe navigation
- Respond to emergencies
- Respond to distress signals at sea
- Transmit and receive information by visual signaling
- Maneuver the ship

Cargo handling and stowage

- Monitor the loading, stowage, securing and unloading of cargoes and their care during the voyage
- Inspect and report defects and damage to cargo spaces, hatch covers and ballast tanks

Controlling the operation of the ship care for persons on board:

- Maintain seaworthiness of the ship

Entry Standards

The trainees of this course shall be those deck officers whose professional certificate has expired, as they have not sailed a minimum of twelve month during the last five years or three months during the last year.

Therefore, it is assumed that trainees undertaking this course have accomplished some formal instruction in terrestrial navigation, have at least some familiarization with visual navigation, have accomplished a period of supervised bridge watch-keeping duties, and have prior completion of basic Radar/ARPA (MC 1.07). Trainees should also have considerable familiarization with personal computing operating systems, keyboards and mice/trackballs.

Course Certificate

Documentary evidence should be issued to those who have successfully completed this course indicating that the holder has completed his/her training and has been evaluated for this course.

This certificate shall accredit that the holder has demonstrated the knowledge, skills and understanding of the mentioned competences required by the STCW Code for his/her capability to exercise as officer in charge of navigation.

Notwithstanding, the holder shall complete his/her trainee with the rest of the competences which are not assessed by simulator.

Course delivery

The outcome of this course is structured in seven groups of exercises or general subject areas, which assess and evaluate at the same time more than one competence. These groups or subject areas are:

1. Familiarization with the different kinds of simulators
2. Planning a voyage
3. Watchkeeping
4. Manoeuvering
5. Cargo handling for different kinds of ships
6. Emergencies and rescue
7. Controlling the operations of the ship and care on board

Moreover, methods of distance learning or computer-based training may be used to provide familiarization with the contents of this course, but should not be substituted for the underway assessment of proficiency.

Course intake limitations

The maximum number of trainees should depend on the facilities and equipment available, bearing in mind the scope and objectives of this course.

The instructor – trainee ratio should be limited to 1:12. When a class size exceeds 12 trainees, an assistant instructor is required.

Staff requirements

The following are the minimum qualifications recommended for instructors delivering a course that follows the IMO Model Course 1.27, 3.12 and 6.10. The instructor in charge should:

Hold relevant certificate of competency in the deck department or other

qualification or experience at the discretion of the administration approving the course;

- Hold the Certificate of General Operator of the Global Maritime Distress and Safety System;
- Hold the Certificate of Automatic Radar Plotting Aids (ARPA);
- Have successfully completed an approved ECDIS course;
- Have completed type specific familiarization relevant to the equipment used for training;
- Have a detailed knowledge of the requirements of SOLAS chapters V/2, V/19, and V/20-27, as amended;
- Have an up-to-date knowledge of the IMO ECDIS Performance Standards currently in force and knowledge of relevant STCW requirements and guidance;
- Have an up-to-date knowledge of ENCs;
- Be fully aware of current ENC data transfer standards and presentation libraries of the IHO, methods of ENC licensing and updating and current IMO recommendations on ECDIS software and other issues;
- Have a current relevant teaching qualification or have successfully completed a Train-The-Trainer course, including the application of simulators in training and meets the requirements of STCW regulation I/6 and I/12.

Assistant instructors should have relevant knowledge of ECDIS operation.

Teaching Facilities and equipment

As indicated below, in Teaching Aids, this course has plenty of teaching facilities and equipment, but the main equipment for the purpose of this course, is a set of simulators that allow to simulate the required training conditions.

The radar and ship handling simulators are the most well-known and widespread, but it is quite surprising to see which other types of activities and equipment have become models for a maritime training simulator system and have been developed and installed:

- Navigation equipment trainer **(NAV)**
- Communication procedures/GMDSS equipment trainer **(COM)**
- Radar simulator **(RAD)**
- Radar and navigation simulator **(NAV/RAD)**
- Ship handling simulator with/without motion platform/image generation **(SHIP)**
- Crane handling simulator **(CRA)**
- Vessel traffic management simulator **(VTS)**
- Search and rescue management trainer **(SAR)**
- Oil spill management trainer **(SPILL)**
- Cargo handling trainer **(CAR)**
- Ballast control trainer **(BAL)**

This list is not intended to be all-inclusive.

Note: names in brackets and bold, are assigned to refer to each particular type of simulator later on.

In addition to the trainee work stations there must be an instructor station with dedicated projection system that will allow projection of the exercises and lecture materials. It is strongly recommended

that there be display(s) networked to the instructor station, thereby allowing display(s) of ARPA and ECDIS information (or other training material) for the benefit of the trainees.

Note that the lecturing may take place in the same room as the simulation if the space is suitable. This would require adequate visibility around/over the workstations to the whiteboard/chalkboard and projection screens, and adequate work space for taking notes and written examinations.

Briefing and Debriefing sessions

The debriefing session is a vital phase of a simulation, since this is when consolidation of lessons learned is accomplished. An atmosphere of candour must be encouraged, while participants take responsibility for assessing actions and results of decisions made during simulation.

While one group is using the simulator the other group should be debriefed on the previous exercise and briefed on the following one. When a group finishes the day with an exercise, it is preferable to extend the session to include the debriefing while the exercise is still fresh in the trainees' minds rather than to postpone it until the following day.

The time spent on debriefing will vary from exercise to exercise and should occupy between 25 and 30 per cent of the total time used for simulator exercises.

Various facilities may be used to assist in debriefing, such as playback (in which the whole exercise is recorded and any sequence is available for discussion), plotters (which record the tracks made by the ships), data-logging equipment and voice recorders.

Teaching aids (A)

A1: Different kinds of simulators
A2: Instructor Manual (Part D of the revalidation course)
A3: Nautical charts and publications

- Catalogue of British Admiralty Charts and other Hydrographic Publications
- British Admiralty Notices to Mariners
- Charts
- British Admiralty List of Lights
- National List of lights and Buoyage System
- British Admiralty Tide Table of the area concerned
- National tide table
- British Admiralty Sailing Directions for the area concerned
- National sailing directions
- The Mariner's Handbook (NP100)
- Ocean Passages for the World (NP136)
- Nautical Almanac
- Pilot chart of the ocean concerned (US Hydrographic Office publication)
- Ocean plotting sheet
- British Admiralty List of Radio Signals
- Ship's Log-book
- Pre-compute altitude and azimuth table
- Sight Reduction Tables for Navigation AP 3270 Vol. 1

A4: Audiovisual aids: video tutorial, power point, auto-test, etc.
A5: Records of the simulations
A6: Other specific material, such as sextant and azimuth mirror

Bibliography (B)

B1 NMEA Interface Standard 0183 v.4.10. Severna Park, MD: National Marine Electronic Association, 2008

B2 Facts about electronic charts and carriage requirements, S-66, 1.0.0 Ed. Monaco: International Hydrographic Bureau, 2010

B3 Gale, H. From Paper Charts to ECDIS. London: Nautical Institute, 2009

B4 Bole [et al.]. Ancillary Equipment (Chapter 10). A: The Radar/ARPA Manual. Amsterdam: Elsevier, 2013. ISBN 978-0-08-097752-2.

B5 Electronic Charts (Chapter 14). A: American Practical Navigator: Pub. No.9. Bethesda, Ma.: NIMA, 2002.

B6 Simulator reference manual (Manufacturer, Date)

B7 User's manual accompanying the ECDIS software utilized during the training course

B8 IEC 61174: Maritime navigation and radiocommunication equipment and systems – Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results, Edition 3.0, International Electrotechnical Commission, 2008. ISBN 978-2-88910-432-1

B9 IHO Special Publication No 66: Facts about electronic charts and carriage requirements, Edition 1.0. Monaco: International Hydrographic Organization, 2010

B10 IHO S-61: Product specifications for Raster Navigational Charts (RNC), Edition 1.0. Monaco: International Hydrographic Organization, 1999.

B11A IHO S-52: Specifications for chart content and display aspects of ECDIS, Monaco: International Hydrographic Organization, 2010.

B11B S-52 Chart Presentation Bulletins (CPB)

B12 IHO S-100: Universal Hydrographic Data Model, Ed. 1.0.0. Monaco: International Hydrographic Organization, 2010.

B13 IHO S-57: IHO Transfer Standard for Digital Hydrographic Data, Edition 3.1. Monaco: International Hydrographic Organization, 2000.

B14 Dutton's Nautical Navigation, 15th ed. Naval Institute Press, 2003. 978-1557502483

B15 Burger, W. Radar Observer's Handbook for Merchant Navy officers, 9th Revised Ed. Glasgow: Brown, Son and Ferguson, 1999. ISBN 978-0851746661.

B16 Crane, C.L. Maneuvering Trials of the 278,000 DWT Esso Osaka in Shallow and Deep Waters: Marine Research Program. Report Number EII. 4TM. 79. Exxon International Company Tanker Department - Research and Development, 1979.

B17 Barrass, C.B. Ship Squat and its Calculation. Safety at Sea, February 1978, No. 107, p.11

B18 Cahill, R.A. Collisions and their causes. London: The Nautical Institute, 2002. ISBN 978-1-870077-60-6

B19 Cahill, R.A. Strandings and their Causes. London, Fairplay Publications, 1985. ISBN 0-905045-60-2

B20 Norrbin, N.H. Bank effects on a ship moving through a short dredged channel. A: Proceedings of the 10th Symposium on Naval Hydrodynamics in Cambridge, Mass., March 1974.

B21 Paffett, J.H.A. Ships and Water. London: The Nautical Institute, 1990, ISBN 1-870077-06-7

B22 SAS Flight Academy, Dutch Maritime Pilots' Corporation, National Board of Navigation, Finland, National Maritime Administration, Sweden, Norwegian Shipowner's Association, Silja Line AB, Swedish Club, Swedish Shipowner's Association, Bridge Resource Management Student's Workbook.

B23 International Health Regulations, 2nd Edition, Ginebra: World Health, 2005, ISBN 978-92-4-158041-0

IMO references (R)

R1 Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW Convention), as amended, 2011 Edition, IMO

R2 International Convention for the Safety of Life at Sea, 1974, as amended (SOLAS), Consolidated Edition 2009, IMO

R3 Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREG 1972), Consolidated Edition 2003, IMO

R4 Model Course 7.03 – Officer in Charge of a Navigational Watch, 1999 Edition, IMO

R5 Model Course 1.22: Ship Simulator and Bridge Teamwork, 2002 Edition, IMO

R6 Assembly Resolution A.893(21) - Guidelines for Voyage Planning, IMO

R7 Ship's Routeing, 2010 Edition, IMO

R8 Adoption of the Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS), MSC. 232(82), 2006 Edition, IMO

R9 Assembly Resolution A.817(19) - ECDIS Performance Standards

R10 Resolution MSC.1/Circ.1391, Operating anomalies identified within ECDIS, 2010

R11 SN.1/Circ.266/Rev. 1, Maintenance of Electronic Chart Display and Information System (ECDIS) Software, 2007

R12 Assembly Resolution A.665(16), – Performance Standards for Radio Direction-Finding, 1989.

R13A Assembly Resolution A.224(VII) – Performance Standards for Echo-Sounding

R13B Resolution MSC.74(69): Annex 4 Recommendation on performance standards for echo-sounding equipment, 1998

R14A Assembly Resolution A.478(XII) – Performance Standards for Device to Indicate Speed and Distance

R14B Assembly Resolution A.824(19) – Performance standards for devices to measure and indicate speed and distance

R14C Resolution MSC.96(72), Adoption of amendments to performance standards for devices to measure and indicate speed and distance, 2000

R15A Assembly Resolution A.342(IX) – Recommendation on Performance Standards for Automatic Pilots

R15B Resolution MSC.64(67) : annex 3, Recommendation on performance standards for heading control systems

R16A Assembly Resolution A.706(17) – World-Wide Navigational Warning Service

R16B IMO MSC.1/Circ.1288, Amendments to resolution A.706(17) – World-wide navigational warning, service, 2008

R17 International Code of Signals

R18 Assembly Resolution A.954(23) – Proper Use of VHF Channels at Sea

R19 International Aeronautical and Maritime Search and Rescue Manual (IAMSAR Manual), 2013 Edition, IMO

R20 Assembly Resolution A.889(21) - Pilot transfer arrangements

R21A Assembly Resolution A.601(15) – Provisions and display of Manoevering

R21B Assembly Resolution A.751(18) - Interim standards for ship manoeuvrability. (Annex superseded by annex to MSC.137(76))

R22 Assembly Resolution A.953 (23) - World-wide radionavigation system.

R23 Assembly Resolution A.577 (14) - Operational Status of Electronic Position-Fixing Systems

R24 Assembly Resolution A.280 (VIII) – Recommendations on Performance Standards for Gyro-Compasses

R25 Assembly Resolution A.382(X) – Magnetic Compasses: Carriage and Performance Standards

R26A Assembly Resolution A.422(XI) – Performance Standards for Automatic Radar Plotting Aids (ARPA) (Amended by A.823(19))

R26B Assembly Resolution A.823(19) - Performance standards for automatic radar plotting aids (ARPAs)

R26C Resolution MSC.192(79), Adoption of the revised performance standards for radar equipment, 2004

R27 Assembly Resolution A.424(XI) – Performance Standards for Gyro-Compasses

R28 Assembly Resolution A.694(17) - General Requirements for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System (GMDSS) and for Electronic Navigational Aids

R29 Assembly Resolution A.528(13) – Recommendation on Weather Routeing

R30 International Convention for the Prevention of Pollution from Ships, 1973/78 (MARPOL), Consolidated edition 2011, IMO.

R31A International Maritime Dangerous Goods Code (IMDG Code), 2012 Edition, IMO

R31B IMDG Code Supplement, 2010 Edition, IMO

R32 IMO Dangerous Goods Labels, Marks and Signs, 2012 Edition, IMO

R33 Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG)

R34 Emergency Procedures for Ships Carrying Dangerous Goods (EmS)

R35 International Maritime Solid Bulk Cargoes Code (IMSBC Code) and Supplement, 2013 Edition, IMO

R36 Resolution MSC.137(76), Standards for ship manoeuvrability, 2002

R37 Assembly Resolution A. 714(17) - Code of Safe Practice for Cargo Stowage and Securing.

R38 Assembly Resolution A.489(XII) – Safe Stowage and Securing of Cargo Units and Other Entities in Ships Other than Cellular Containers Ships

R39 Assembly Resolution A.533(13) – Elements to be taken into account when considering the Safe Stowage and Securing of Cargo Units and Vehicles in Ships

R40A Assembly Resolution A.581(14) – Guidelines for Securing Arrangements for the Transport of Road Vehicles on Ro-Ro Ships (Amended by MSC/Circ.812)

R40B IMO MSC/Circ.812, Amendments to Assembly Resolution A.581(14) – Guidelines for Securing Arrangements for the Transport of Road Vehicles on Ro-Ro Ships, 1997

R41 International Code for the Safe Carriage of Grain in Bulk (International Grain Code), 1991 Edition, IMO

R42 International Conference on Load Lines, 1966, 2005 Edition, IMO

R43A Assembly Resolution A.760(18) - Symbols related to life-saving appliances and arrangements. Amended by MSC.82(70)

R43B Resolution MSC.82(70), Amendments to resolution A.760(18) on symbols related to life-saving appliances and arrangements, 1998

R44 Assembly Resolution A.921(22) - Assembly resolutions superseded by the 1995 amendments

to the 1978 STCW Convention
R45 International Conference on Special Trade Passenger Ships Agreement, 1971, 1972 Edition, IMO
R46 Protocol on Space Requirements for Special Trade Passenger Ships, 1973, (SPACE STP 1973), IMO
R47 Athens convention relating to the Carriage of Passengers and their Luggage by Sea, 1974 (PAL 1974), IMO
R48 International Convention on Tonnage Measurement of Ships, 1969, IMO
R49 Assembly Resolution A.769(18) – Procedures and Arrangements for Issuing GMDSS Certificates to Holders of Non-GMDSS Certificates
R50 IMO/ILO Document for Guidance, 1985, IMO
R51 International Safety Management Code (ISM Code) and Guidelines on implementation of the ISM Code, 2010 Edition, IMO
R52 International Life-Saving Appliance (LSA Code), 2010 Edition, IMO

Textbooks (T)

T1 Norris, A. ECDIS and Positioning. London: The Nautical Institute, 2010.
T2 Weintrit, A. The Electronic Chart Display and Information System (ECDIS): An Operational Handbook. Gdynia: Gdynia Maritime University, Poland, Balkema Book, CRC Press, Taylor & Francis Group, 2009.
T3 Hecht [et al.]. The Electronic Chart, Fundamentals, Functions, Data and other Essentials A Textbook for ECDIS Use and Training, 3rd Revised Edition. Lemmer, The Netherlands: Geomares Publishing, 2011.
T4 The ECDIS Manual, ECDIS Ltd, Witherby: Seamanship International, 2012.
T5 The Admiralty Manual of Navigation: Principles of Navigation. London: the Nautical Institute, 2008. ISBN 978-1-870077-90-3.
T6 Emms, Christopher. An introduction to Coastal Navigation: A Seman's Guide. 4th ed. Wooten-under-Edge (UK): Morgans Technical Books, 1985. ISBN 0-948254-02-5.
T7 Boole, A.G.; Dineley, W.O. and Nicholls, C.E.; The Navigation Control Manual. 2nd ed. Oxford: Heinemann Professional, 1992. ISBN 0-7506-0542-1.
T8 Cockroft, A.N.; Lameijer, J.N.F. A Guide to Collision Avoidance Rules, 7th ed. Oxford: Butterworth-Heinemann, 2012. ISBN 978-0080971704.
T9 Frost, A. Practical Navigation for Second Mates, 6th. Ed. Glasgow: Brown, Son & Ferguson, 1985.
T10 Frost, A. The Principles and Practice of Navigation. 3rd. Ed. Glasgow: Brown, Son & Ferguson, 1988. ISBN 0-85174-542-3.
T11 Hooyer, Henry H. The Behaviour and Handling of Ships. Centreville, M.D.: Cornell Maritime Press, 1983. ISBN 0-787033-306-2.
T12 Bridge Procedures guide; 4th ed. London: International Chamber of Shipping, 2007
T13 Peril at Sea and Salvage: A Guide for Masters, 5th ed. London: International Chamber of Shipping; OCIMF, 1998. ISBN 0-984691-46-8.
T14 Accident Prevention on Board Ship at Sea and in Port, 2nd ed. Geneva: International Labour Office, 1996. ISBN 92-2-109450-2.
T15 Kemp, J.F.; Young, P. Notes on Compass Work, 2nd ed. London: Stanford Maritime, 1972. ISBN 0-540-00362-x.

T16 Lownsborough, R.; Calcutt, D. Electronic Aids to Navigation: Radar and ARPA. 1st ed. London: Edward Arnold, 1993. ISBN 0-340-59258-3.

T17 MacElvrey, D.H. Shiphandling for The Mariner, 3rd ed. Centreville, Maryland: Cornell Maritime Press, 1995. ISBN 0-87033-464-6.

T18 Cornish, M. Reeds Maritime Meteorology. 3rd Ed. Updated. : Sunderland: Thomas Reed Publications: 2009. ISBN 978-1-4081-1206-9.

T19 Marine Observer's Handbook, 11th ed. London, HMSO: 1995. ISBN 0-11-400297-5.

T20 Meteorology for Mariners (Met.0.895), 3rd Ed. Revised. London: HMSO, 1996. ISBN 0-114-00367X.

T21 The Shiphandler's Guide. London: The Nautical Institute, 2000. ISBN 978-1-870077-35- 4.

T22 Swift, A.J. Bridge Team Management: A Practical Guide, 2nd Ed. London: The Nautical Institute,2004. ISBN 1-870077-66-0

T23 Tetley, L.; Calcutt, D. Electronic Aids to Navigation. London: Edward Arnold, 1986. ISBN 0-7131-3548-4.

T24 Wright, C.H. Collision Regulations: Fully Explained. 2nd ed. Glasgow: Brown, Son & Ferguson, 1989. ISBN 0-904-825-08-6.

T25 Squat and Interaction Manoeuvring, London: The Nautical Institute, 1995. ISBN 978-1-870077-25-5

T26 Derret, D.R.; Barrass, B. Ship Stability for Masters and Mates, 7th ed. Oxford: Butterworth-Heinemann, 2008. ISBN 978-0080970936

T27 ISGOTT: International Safety Guide for Oil Tankers & Terminals, 5th ed. Revised. London: Witherby & Co. Ltd, 2006. ISBN 978-1856092913

T28 Lavery, H.I. Shipboard Operations, 2nd ed. London: Heinemann, 1990. ISBN 0-4434-91094-0

T29 Morton, G.S. Tanker Operations: A Handbook for the Ship's Officer, 3rd ed. Cambridge : Cornell Maritime Press, 1992. ISBN 0-87033-432-8.

T30 Taylor L.G. Cargowork, 12th ed. Glasgow: Brown, Son & Ferguson Ltd. 1992. ISBN 0-85174-605-5.

T31 Pepper, G.M. Thoma's Stowage: The Properties and Stowage of Cargoes, 5th ed. Glasgow: Brown, Son & Ferguson, 2008. ISBN 9780851747989

T32 Code of Safe Working Practices for Merchant Seamen, Consolidated Edition. London: The Stationery Office Publications Centre, 2010. ISBN 978-0-11-553170-5

T33 Taylor, D.A. Merchant Ship Construction, 4th ed. London: Institute of Marine Engineers, 1998. ISBN 978-1902536002

T34 Roberts, P. Watchkeeping safety and cargo management in port. London: The Nautical Institute, 1995. ISBN 1-870077-29-6

Part B: Course Outline and Timetable

Overview

The following section presents the topics of the 43-hour course in a simplified outline format. The 37 topics are organized into 7 general Subject Areas or exercises:

1. Familiarization with simulators
2. Planning a voyage
3. Watchkeeping
4. Manoeuvering
5. Cargo handling for different kinds of ships
6. Emergencies and rescue
7. Controlling the operations of the ship and care on board

A familiarization with the simulation tools is also necessary for the trainee. For evaluating the trainee, these exercises should be shorter, and he/she should select one from each group.
Planning voyage and watchkeeping exercises are single but long exercises; **manoeuvering exercises** depend on whether the ship berths, unberths, anchors, etc., and the **cargo handling exercises** also depend on the kind of cargo/type of ship. **Emergencies and rescue group** consist of some skills/knowledge areas that need one or more exercises for each area. It is also important to note that the supporting materials should be exposed, and the trainee should be evaluated, before each simulator session.
Another important point involves elaborating all supporting materials (SM), and finally, determining the time required for explaining and evaluating all skills/knowledge points.
The following table shows the evaluable competences in each group.

Exercise	Competences for the Operational level
1. Familiarization	
2. Planning a voyage	**Competence 1.b:** Terrestrial and coastal navigation: 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 **Competence 2.c**: The use of routeing in accordance with the General Provisions on Ship's Routeing
3. Watchkeeping	**Competence 1.** Celestial Navigation; Terrestrial and coastal navigation; Electronic systems of position fixing and navigation; Echo-sounders; Compass – magnetic and gyro; Steering control system; Meteorology. **Competence 2.** Thorough knowledge of the content of the International Regulations for Preventing Collisions at Sea, 1972, as amended; Thorough knowledge of the content of the International Regulations for Preventing Collisions at Sea, 1972, as amended; The use of information from navigational equipment for maintaining a safe navigational watch; Knowledge of blind pilotage techniques; The use of reporting of accordance with the General Principles for Ship Reporting Systems and the VTS procedures; Knowledge of bridge resource management principles **Competence 3.** Knowledge of the fundamentals of radar and automatic radar plotting aids; Ability to operate and to interpret and analyse information obtained from radar; Principal types of ARPA, their display characteristics, performance standards and the dangers of over-reliance on ARPA; Ability to operate, interpret and analyse information obtained from ARPA

Exercise	Competences for the Operational level
	Competence 4. Knowledge of the capability and limitations of ECDIS operations; Proficiency in operation, interpretation, and analysis of information obtained from ECDIS
4. Manoeuvering	**Competence 8.** The effect of deadweight, draught, trim, speed and under-keel clearance on turning circles and stopping distances; The effects of wind and current on ship handling; Maneuvers and procedures for rescuing a person overboard; Squat, shallow-water and similar effects; Proper procedures for anchoring and mooring.
5. Cargo handling	**Competence 9.** Knowledge of the effect of cargo, including heavy lifts, on the seaworthiness and stability of the ship; 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; Ability to establish and maintain effective communications during loading and unloading. **Competence 10.** Inspect and report defects and damage to cargo spaces, hatch covers and ballast tanks
6. Emergencies and rescue	**Competence 5.** Emergency procedures **Competence 6.** Search and rescue. Knowledge of the contents of the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual **Competence 7.** Visual signalling
7. Controlling the operations	**Competence 11.** Ship stability; Ship construction

Table 1. Main Structure of the course considering competences to be evaluated

The total number of hours is allocated in the following manner:

Familiarization with simulators	Briefings, debriefings and no-simulation explanations	Simulation trainings	Evaluation in simulators	Evaluation with theoretical exam
2.0 hrs	**16.0 hrs**	**22.0 hrs**	**2.0 hrs**	**1.0 hrs**

The duration allocated to each topic is presented in the Course Timetable, and is repeated in Part C – Detailed Teaching Syllabus, and in Part D – Lesson Plans and Exercises. The Learning Objectives for each topic are presented generally in Part C, and with full detail in Part D.

As defined in Part A – Course Framework, the Classroom setting should provide one workstation for each trainee, and all workstations should be networked with the simulation instructor and server.

Course Outline

Familiarization with simulators	Hours
01. Knowledge of the fundamentals and limitations of the simulators used in the course (0.5 h) 02. Ability to operate and to interpret and analyse information obtained from simulators (1.5 h)	2.0

Planning a voyage	Hours
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 (1.5 h) 04. The use of routeing in accordance with the General Provisions on Ship's Routeing (0.5 h)	2.0

Watchkeeping (20 hrs)	Hours
Position and equipment 05. Celestial navigation (2.0 h) 06. Terrestrial and costal navigation (2.0 h) 07. Electronic system of position fixing and navigation (0.5 h) 08. Echo-sounders (0.5 h) 09. Compass – magnetic and gyro (0.5 h) 10. Steering control system (0.5 h) 11. Meteorology (2.5 h)	8.5
Procedures 12. Thorough knowledge of the content of the International Regulations for Preventing Collisions at Sea, 1972, as amended (2.5 h) 13. Thorough knowledge of the Principles to be observed in keeping a navigational watch (0.5) 14. The use of information from navigational equipment for maintaining a safe navigational watch (0.5 h) 15. Knowledge of blind pilotage techniques (1.0 h) 16. The use of reporting of accordance with the General Principles for Ship Reporting Systems and the VTS procedures (0.5 h) 17. Knowledge of bridge resource management principles (0.5 h)	5.5
Radar / ARPA 18. Knowledge of the fundamentals of radar and automatic radar plotting aids (0.5 h) 19. Ability to operate and to interpret and analyse information obtained from radar (1.0 h) 20. Principal types of ARPA, their display characteristics, performance standards and the dangers of over-reliance on ARPA (0.5 h) 21. Ability to operate, interpret and analyse information obtained from ARPA (1.0 h)	3.0
ECDIS 22. Knowledge of the capability and limitations of ECDIS operations (0.5 h) 23. Proficiency in operation, interpretation, and analysis of information obtained from ECDIS (2.5 h)	3.0

Manoeuvering	Hours
24. Effect of deadweight, draught, trim, speed and under-keel clearance on turning circles and stopping distances (0.5 h) 25. Effects of wind and current on ship handling (0.5 h)	4.0

26. Maneuvers and procedures for rescuing a person overboard (1.0 h) 27. Squat, shallow-water and similar effects (0.5 h) 28. Proper procedures for anchoring and mooring (1.5 h)	

Cargo handling	**Hours**
29. Knowledge of the effect of cargo, including heavy lifts, on the seaworthiness and stability of the ship (2.5 h) 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 (2.0 h) 31. Ability to establish and maintain effective communications during loading and unloading (0.5 h) 32. Inspect and report defects and damage to cargo spaces, hatch covers and ballast tanks (1.0 h)	6.0

Emergencies and rescue	**Hours**
33. Emergency procedures (1.0 h) 34. Search and rescue: knowledge of the contents of the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual (1.0 h) 35. Visual signaling (1.0 h)	3.0

Controlling the operations	**Hours**
36. Ship stability (2.0 h) 37. Ship construction (1.0 h)	3.0

Course Timetable

Generally, each simulation training has a duration of 2 hours; being the first half hour a briefing, the last half hour a debriefing, with one hour of simulation in between.

The following timetable has been thought for doing 2 sessions in the mornings and 1 session in the afternoons during 7 days. Between both morning sessions a break of half an hour is recommended. For example, if the first session starts at 09.00 and finishes at 11.00; the second one starts at 11.30 and finishes at 13.30, and the third one starts at 16.00 and finishes at 18.00, except for the last day (evaluation) that it finishes at 19.00. Otherwise, a more intensive course may be done with 2 sessions in the morning and two other sessions in the afternoons during 5 days, adding a sixth morning for evaluating the trainees. In both cases, the course consists of 20 sessions of 2 hours and one exam of 3 hours.

In the timetable, S and NS indicate whether the knowledge/skill can be acquired by a simulation or not.

Day/ Period	1st Period (2.0 hours)	2nd Period (2.0 hours)	3rd Period (2.0 hours)
Day 1	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 (0.5h) **S** and (1h) **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**
Day 2	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)
Day 3	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)
Day 4	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** **NS**

Day 5	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. hip 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)	38. Evaluation with theoretical exam (1.0 h) **NS** 39. Evaluation in simulators (2.0 h) **S**

Note: Teaching staff should note timetables are suggestions only as regards the sequence and length of time allocated to each objective. These factors may be adapted by instructors to suit individual groups of trainees depending on their experience and ability and on the equipment and staff available for the training.

- The first session corresponds to Subject Area 1: Familiarization with the different kinds of simulators (2 hours of simulation).
- The second session corresponds to Subject Area 2: Planning a voyage (0.5 hours of simulation and 1.5 hours using only teaching aids).
- Sessions Nr. 3 to Nr. 12 (both included) correspond to Subject Area 3: Watchkeeping (11.5 hours of simulation and 8.5 hours using only teaching aids);
- Sessions Nr. 13 and 14 correspond to Subject Area 4: Manoeuvering (4 hours of simulation).

- Sessions Nr. 15 to Nr.17 correspond to the Subject Area 5: Cargo handling (2 hours of simulation and 4 hours using only teaching aids)
- Session Nr. 18 and the first half of Nr. 19 correspond to Subject Area 6: Emergencies and rescue (2.5 hours of simulation and 0.5 hours using only teaching aids).
- Session Nr. 20 and the second half of Nr. 19 correspond to Subject Area 7: Controlling the operations (1.5 hours of simulation and 1.5 hours using teaching aids).

Therefore, the exercises of the first and second group require only a session each one, but the other exercises are longer than a session. Thus, the times in brackets are the duration of each complete training exercise.

Part C: Detailed Teaching Syllabus

The detailed teaching syllabus has been written in learning objective format in which the objective describes what the trainee should do to demonstrate that knowledge has been transferred. All objectives are understood to be prefixed by the words, “The expected learning outcome is that the trainee…”

In order to assist the instructor, reference publications are shown against the learning objectives in addition technical material and teaching aids, which the instructor may wish to use when preparing course material. 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);
and Textbooks (indicated by T)

In IMO courses, Electronic Media are indicated by E, but in this case, IAMU has considered, according to the objective of this course, that makes no sense to distinguish between electronic media and other teaching aids. Therefore, simulators, like audiovisual aids and recordings, are referred to as a teaching aid, indicated by A.

The following table gives, in a wider form, the knowledge/skills of each topic, and the teaching aids and references that are used. The teaching aids are referred for each specific knowledge/skill, while the references are given for a whole subject area, except for watchkeeping, due to its extension.

Note

Throughout the course, safe working practices are to be clearly defined and emphasized with reference to current international requirements and regulations. It is expected that the institution implementing the course will insert references to national and/or regional requirements and regulations as necessary.

Learning Objectives

Subject areas and topics have been outlined in Part B. In Part C, the Learning Objectives associated with each topic are provided, along with teaching aids and references. In Part D, the topics are referred to as Lesson Plans, and the Learning Objectives are further described in sufficient detail for the development of a revalidation of the correspondent National Certificate of Officer in Charge of a Navigational Watch. The Learning Objectives are presented in a verb-based manner to facilitate outcomes-driven learning and skills development. All Learning Objectives are understood to be prefixed by the phrase: “The expected learning outcome is that the trainee is able to . . . .”

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
1.Familiarization with simulators (2 hours)		
1.1 Knowledge of the fundamentals and limitations of the simulators used in the course (0.5 h) – Topic 01	A1 A2	B6 B7 R51
1.2. Ability to operate and to interpret and analyse information obtained from simulators (1.5 h) – Topic 02	A1	
- Navigation equipment trainer (NAV)		
- Communication procedures/GMDSS equipment trainer (COM)		
- Radar simulator (RAD)		
- Radar and navigation simulator (NAV/RAD)		
- Ship handling simulator with/without motion platform/image generation (SHIP)		
- Crane handling simulator (CRA)		
- Vessel traffic management simulator (VTS)		
- Search and rescue management trainer (SAR)		
- Oil spill management trainer (SPILL)		
- Cargo handling trainer (CAR)		
- Ballast control trainer (BAL)		

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
2. Planning a voyage (2 hours)		
2.1. Thorough knowledge of and ability to use nautical charts, such as sailing directions, tide tables, notices to mariners, navigational radio warnings and ship's routeing information (1.5 h) – Topic 03	A1 A2 A3	R1 R2 R4 R6 R7 R8 R9 R10 T5 T6 T7 T9 T10
2.1.1 Use of the catalogue of charts, Ship's routeing and Sailing Directions for preparing a voyage plan.		
2.1.2 Symbols and abbreviations used in Admiralty charts, according to the publications NP-131 Symbols and abbreviations used in Admiralty charts.		
2.1.2 Symbols and abbreviations used in Admiralty charts, according to the publications NP-131 Symbols and abbreviations used in Admiralty charts.		
2.1.3 How to correct nautical charts, and the full content of the Weekly Admiralty Notices to Mariners.		
2.1.4 Explaining how to update ECDIS's.		
2.1.5. Explaining how to draw course lines when charts of different scales are used.		
2.1.6. Explaining how to use the applications of ECDIS's for drawing LOP's such bearings and distances; safety lines; danger or special areas; alarms setting; etc.		
2.1.7. Introducing WP's in the GPS and filling a voyage plan and its check list.		
2.2. The use of routeing in accordance with the General Provisions on Ship's Routeing (0.5 h) – Topic 04	A3	

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
3. A. Watchkeeping – Position and equipment (8.5 h)		
3.A.1. Celestial navigation (2.0 h) – Topic 05	(A1) A2 A3 A4 A6	R1 R2 R4 R5 R8 R9 R10 R12 R13A/B R14A/B/C R15A/B R16A/B R22 R23 R24 R25 R26A/B/C R27 R28 R51 T5 T6 T7 T9 T10 T15 T16 T18 T19 T20 T23
3.A.1.1. Practice in the use of the sextant		
3.A.1.2. Sextant corrections		
3.A.1.3. Refreshing how to obtain the ship's position at noon		
3.A.1.4. R. Refreshing how to obtain the ship's position by observing stars during the crepuscules and using the Sight Reduction Tables for Navigation: AP 3270 Vol. 1 (UK) – Pub. No. 249 Vol.1 (US)		
3.A.1.5. Providing programmes that make calculations		
3.A.2. Terrestrial and costal navigation (2.0 h) – Topic 06	A1 A2 A3 A4	
3.A.2.1. Ability to determine the ship's position by use of:		
Landmarks		
Aids to navigation, including light houses, beacons and buoys using different kinds of LOP's: distances, bearings (visual and EBL), horizontal angles, etc.		
3.A.2.2. Dead reckoning, taking into account winds, tides, currents and estimated speed; ETA calculation, etc.		
3.A.3. Electronic system of position fixing and navigation (0.5 h) – Topic 07. Ability to determine the ship's position by using electronic navigational aids.	A1 A2 A3	
3.A.4. Echo-sounders (0.5 h) – Topic 08	A1 A2 A3 A4	
3.A.4.1. Explaining depth, under keel clearance, shallow water alarm, etc.		
3.A.4.2. Ability to operate the equipment and apply the information correctly.		

3.A.5. Compass – magnetic and gyro (0.5 h) – Topic 09	A1 A2 A3 A4	
3.A.5.1. Knowledge of the principles of magnetic and gyro-compasses		
3.A.5.2. Ability to determine errors of magnetic compasses and gyro-compasses, using celestial and terrestrial means, and to allow for such errors		
3.A.6. Steering control system (0.5 h) – Topic 10. Knowledge of steering control systems, operational procedures and Change over from manual to automatic control and vice versa. Adjustment of controls for optimum performance.	A1	
3.A.7. Meteorology (2.5 h) – Topic 11	A1 A2 A3 A4	
3.A.7.1. Ability to use and interpret information obtained from shipborne meteorological instruments.		
3.A.7.2. Knowledge of the characteristics of the various weather systems, reporting procedures and recording systems.		
3.A.7.3. Ability to apply the meteorological information available.		
3.A.7.4. Ability to interpret information from pilot charts.		
3.A.7.5. General explanation of the OTSR - Weather routeing.		

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
3.B. Watchkeeping – Procedures (5.5 h)		
3.B.1. Thorough knowledge of the content of the International Regulations for Preventing Collisions at Sea, 1972, as amended (2.5 h) – Topic 12	A2 A4	R1 R2 R4 R5 R8 R9 R10 R11 R12 R13A/B R14A/B/C R15A/B R16A/B R18 R22 R23 R24 R25 R26A/B/C R27 R28 R29 R51 T8 T12 T16 T22 T23 T24 T34
3.B.2. Thorough knowledge of the Principles to be observed in keeping a navigational watch (0.5 h) – Topic 13	A2 A4	
Navigation: course, speed, voyage plan, charts, position, depth, etc.		
Areas of navigation: aids to navigation, report points, areas to avoid, TSS, shallow waters, narrow channels, etc.		
Ship's limitations: draft, distance to stop, evolution curve, etc.		
Traffic		
Meteorology: weather, sea state, visibility, etc.		
3.B.3. The use of information from navigational equipment for maintaining a safe navigational watch (0.5 h) – Topic 14	A1 A3	
3.B.4. Knowledge of blind pilotage techniques (1.0 h) – Topic 15	A1 A3	
3.B.4.1. Use of the radar/ARPA for obtaining the ship's position.		
3.B.4.2. Use of the radar for observing the safety distance from shore (points, islands, rocks, etc), buoys, etc. Cross track error and parallel index.		
3.B.4.3. Plotting of echoes and maneuver for avoiding collisions.		
3.B.4.4. Use of ARPA for plotting and maneuver for preventing collisions, taking into account TCPA, trial maneuver and its delay.		
3.B.5. The use of reporting in accordance with the General Principles for Ship Reporting Systems and the VTS procedures (0.5 h) – Topic 16	A1	
3.B.6. Knowledge of bridge resource management principles (0.5 h) – Topic 17. Knowledge of bridge resource management principles, including:	A2 A4 A5	
- allocation, assignment, and prioritization of resources		
- effective communication		
- assertiveness and leadership		
- obtaining and maintaining situational awareness		
- consideration of team experience		

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
3.C. Watchkeeping – Radar / ARPA (3.0 h)		
3.C.1. Knowledge of the fundamentals of radar and automatic radar plotting aids (0.5 h) – Topic 18	A2 A4	R1 R2 R3 R4 R5 R26A/B/C R51 T16
3.C.2. Ability to operate, interpret and analyse information obtained from radar (1.0 h) – Topic 19. This skill includes the following items:		
3.C.2.1. General:		
1. factors affecting performance and accuracy setting up and maintaining displays		
2. detection of misrepresentation of information, false echoes, sea return, etc., beacons and SARTs		
3.C.2.2. Use:	A1	
1. range and bearing; course and speed of other ships; time and distance of closest approach of crossing, meeting overtaking ships		
2. identification of critical echoes; detecting course and speed changes of other ships; effect of changes on ship's own course and speed or both		
3. application of the International Regulations for Preventing Collisions at Sea, 1972, as amended		
4. plotting techniques and relative – and true – motion concepts		
5. parallel indexing		
3.C.2.3. Principal types of ARPA, their display characteristics, performance standards and the dangers of over-reliance on ARPA (0.5 h) – Topic 20	A2 A4	
3.C.2.4. Ability to operate, interpret and analyse information obtained from ARPA (1 h) – Topic 21. This skill includes the following items:		
1. system performance and accuracy, tracking capabilities and limitations, and processing delays		
2. use of operational warnings and system tests	A1	
3. methods of target acquisition and their limitations		
4. true and relative vectors, graphic representation of target information and danger areas		
5. deriving and analyzing information, critical echoes, exclusion areas and trial maneuvers		

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
3.D. Watchkeeping – ECDIS (3.0 h)		
3.D.1. Knowledge of the capability and limitations of ECDIS operations (0.5 h) – Topic 22	A2 A4	R1 R2 R4 R5 R8 R9 R10 R11 R51 T1 T2 T3 T4
3.D.1.1. Thorough understanding of Electronic Navigational Chart (ENC) data, data accuracy, presentation rules, display options and other chart data formats.		
3.D.1.2. The danger of over-reliance.		
3.D.1.3. Familiarity with the functions of ECDIS required by performance standards in force.		
3.D.2. Proficiency in operation, interpretation, and analysis of information obtained from ECDIS (1.5 h) – Topic 23	A1	
3.D.2.1. Use of functions that are integrated with other navigation systems in various installations, including proper functioning and adjustment to desired settings.		
3.D.2.2. Safe monitoring and adjustment of information, including own position, sea area display, mode and orientation, chart data displayed, route monitoring, user-created information layers, contacts (when interfaced with ASIS and/or radar tracking) and radar overlay functions (when interfaced).		
3.D.2.3. Confirmation of vessel position by alternative means.		
3.D.2.4. Efficient use of settings to ensure conformance to operational procedures, including alarm parameters for anti-grounding, proximity to contacts and special areas, completeness of chart data and chart update status, and backup arrangements.		
3.D.2.5. Adjustment of settings and values to suit the present conditions.		
3.D.2.6. Situational awareness while using ECDIS including safe water and proximity of hazards, set and drift, chart data and scale selection, suitability of route, contact detection and management, and integrity of sensors.		

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
4. Manoeuvering (3.0 h)		
4.1. Effect of deadweight, draught, trim, speed and underkeel clearance on turning circles and stopping distances (0.5 h) – Topic 24	A1 A2	R1 R2 R4 R5 R20 R21A/B R51 R52 T17 T21 T22 T25
4.2. Effects of wind and current on ship handling (0.5 h) – Topic 25	A1 A2	
4.3. Maneuvers and procedures for rescuing a person overboard (1.0 h) – Topic 26		
4.3.1. Explaining that the objective of the maneuvers for rescuing a person overboard is to proceed to the exact point where he fell into the water, or proceed the opposite course, avoiding any cross track deviation; and explaining that the proper maneuver depends on the fall time.	A1 A2	
4.3.2. Manoeuver of Anderson.		
4.3.3. Manoeuver of Williamson.		
4.3.4. Other manoeuvers.		
4.4. Squat, shallow-water and similar effects (0.5 h) – Topic 27	A1 A2	
4.5. Proper procedures for anchoring and mooring (1.5 h) – Topic 28		
4.5.1. Simulation of communications WITH Pilots / Port Control and maneuver of approaching.	A1 A4	
4.5.2. Simulation of berthing.		
4.5.3. Simulation of unberthing.		
4.5.4. Simulation of anchoring.		

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
5. Cargo handling (6.0 h)		
5.1. Knowledge of the effect of cargo, including heavy lifts, on the seaworthiness and stability of the ship (2.5 h) – Topic 29	A2 A4	R1 R2 R4 R5 R30 R31A/B R32 R33 R34 R35 R36 R37 R38 R39 R40A/B R41 R42 R48 R51 T26 T27 T28 T29 T30 T31 T32
5.1.1. Principles of stowing and lashing.		
5.1.2. Effect of cargo on the drafts. Explaining how to load for obtaining the required trim.		
5.1.3. Effect of cargo on the structure of the ship: hog, sag, shear forces, bending moments. Explain how to load for preventing damages in the ship's structure.		
5.1.4. Effect of the cargo on the ship's stability. Explain how to load for preventing a loose of stability.		
5.2. 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 (2.0 h) – Topic 30	A1 A2 A4	
5.2.1. Monitoring the loading, stowage securing, care during the voyage and the unloading of cargoes.		
5.2.2. Dangerous goods: segregations and specific provisions. Use of the IMDG and IMSBC Codes.		
5.3. Ability to establish and maintain effective communications during loading and unloading (0.5 h) – Topic 31	A1	
5.4. Inspecting and reporting defects and damage to cargo spaces, hatch covers and ballast tanks (1.0 h) – Topic 32	(A1) A2 A4	
5.4.1. Knowledge* and ability to explain where to look for damage and defects most commonly encountered due to:		
1. loading and unloading operations		
2. corrosion		
3. severe weather conditions		
4. Ability to state which parts of the ship shall be inspected each time in order to cover all parts within a given period of time		
5.4.2. Identifying those elements of the ship structure which are critical to the safety of the ship		
5.4.3. Stating the causes of corrosion in cargo spaces and ballast tanks and how corrosion can be identified and prevented		
5.4.4. Knowledge of procedures on how to carried out inspections		
5.4.5. Ability to explain how to ensure reliable detection of defects and damages		
5.4.6. Understanding of the purpose of the "enhanced survey program"		
*It should be understood that deck officers need not be qualified in the survey of the ships.		

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
6. Emergency and rescue (3.0 h)		
6.1. Emergency procedures (1.0 h) – Topic 33. Respond to emergencies:	A1 A2 A4	R1 R2 R4 R5 R16A/B R17 R18 R19 R23 R43A/B R45 R46 R47 R48 R51 R52 T13 T14
6.1.1. Precautions for the protection and safety of passengers in emergency situations		
6.1.2. Initial actions to be taken following a collision or a grounding; initial damage assessment and control		
6.1.3. Appreciation of the procedures to be followed for rescuing persons from the sea, assisting a ship in distress, responding to emergencies which arise in port		
6.2. Search and rescue (1.0 h) – Topic 34. Respond to a distress signal at sea: knowledge of the contents of the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual	A1 A2	
6.3. Visual signalling (1.0 h) – Topic 35	A1 A2 A4	
6.3.1. Ability to use the International Code of Signals		
6.3.2. Ability to transmit and receive, by Morse light, distress signal SOS as specified in Annex IV of the International Regulations for Preventing Collisions at Sea, 1972, as amended, in appendix 1 of the International Code of Signals, and visual signalling of single-letter signals as also specified in the International Code of Signals		

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 R43A/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. Instructor Manual

For this CoC revalidation course, the instructor manual section defines the exercise scenario for each of the exercises, taking into account that each exercise has different parts, contents and objectives, which are:

LEVEL/EXERCISE NUMBER. For this CoC revalidation course, the levels are only Operational or Management. Then, an exercise indicates:

- The level: Operational (OP) or Management (MAN).
- The subject area: Familiarization (FAM), Planning a voyage (VOY), Watchkeeping (WAT), Manoeuvering (MAN), Cargo Handling (CAR), Emergencies and rescue (E&R) and Controlling the operations (CON).
- The number of the subject area exercises.

TITLE. The title gives a brief description of the exercise. This description includes: the subject area, the scenario and the type of ship. The scenario depends on the subject area. It includes, although it is not limited to: geographic area, cargo to be loaded/discharged or emergency (fire, collision, grounding, etc.).

REFERENCES. References are publications and books where the instructor and the trainee can find the theoretical knowledge they shall apply during the simulation.

OBJECTIVES. A clear conception of the objectives of the exercise is required by the instructor and the trainee. Each exercise has some generic objectives. Moreover, during the training session, more specific objectives must be indicated by the instructor, and these objectives are expected to be accomplished by the trainees. Thus, each exercise has:

- Required instructor actions
- Expected student actions

With the required instructor actions, the instructor creates some simulated conditions by means of which the trainee learns the proper actions to be taken. On the other hand, the expected student actions learn or evaluate the response of the trainee by observing if he/she is taking the expected actions with the conditions simulated by the instructor. In addition, the list of expected student actions can be used as the exam guide, as it should correspond with the aspects inquired in the exam. Therefore, in each exercise, the required instructor actions and the expected students' actions must be indicated.

PREREQUISITES. Before the training session, the students must be familiarized with some knowledge and skills. If they are not familiar with these skills/knowledge, probably they will not be able to take the proper action during the training session or will not understand the objectives of the exercise. Note that these prerequisites depend on the generic objectives of the exercise.

BRIEFING. Once the objectives are determined and the prerequisites guaranteed, trainees need some knowledge about more specific prerequisites for a proper comprehension of the conditions and the actions to be taken during the simulation session. For this reason, those skills/knowledge must be explained before the simulation session.

TRAINING MATERIALS. Training materials are the teaching aids as defined in the part C of the model course. Some of them are necessary for each exercise.

INITIAL CONDITION OF THE SIMULATOR. It also depends on the kind of exercise, and therefore, on the kind of simulator required for the exercise. The initial simulator condition depends on the parameters the simulator has; however, in any case, the initial conditions must be specified.

STUDENT AND INSTRUCTOR ACTIONS. Both actions must be clearly defined, specially the instructor ones, because the exercise depends on his/her action. On the other hand, each exercise requires some student actions which determine whether he/she is has the evaluated skills. For a clear assessment, these student actions must be specified.

DURATION AND TIMETABLE. The duration and the contents of the briefing and debriefing must be specified. Moreover, the development of the exercise must also be quantified.

SIMULATOR RUN. In the simulation, the skills and times must be accurately determined as well as the required instructor actions and expected student actions so that the exercise can be properly evaluated.

DEBRIEFING/EVALUATION. After the simulation, a discussion of the exercise is required, especially of those aspects students had problems with or of the incorrect or inappropriate actions. This is very important for the trainee, because he/she does not only learn from the teacher explanations and the above mentioned references, but also from his/her own mistakes. Consequently, the analysis of his/her improper action becomes knowledge that he/she is going to remember in a real situation, which increases the safety of navigation, cargo operations, etc.
Furthermore, the evaluation consists in: checking whether students are capable (all objectives met) of using the bridge equipment properly in future exercises.

EXAMPLE:
In the following pages, we attach an example considering the above sections:
LEVEL/EXERCISE NUMBER: *OP/FAM/1; i.e.: exercise number 1 for the subject areas of Familiarization and Operational level.*
TITLE: *Bridge familiarization. Dover Strait. TSS off Boulogne. Bulkcarrier. This title indicates that: this exercise is about bridge familiarization; it consists of two simulations in different simulated areas (the Dover Strait and the TSS off Boulogne), and in both cases, the simulated ship is a bulkcarrier.*
REFERENCES:

- *Bridge watchkeeping (Nautical Institute ISBN 1870077172)*
- *Bridge Team Management (Nautical Institute ISBN 1870077660)*
- *Mariner's Handbook*

OBJECTIVES:
Generic objectives: Familiarize the student with:

- *Introduction in the use of simulators*
- *Familiarization with the simulator and equipment*

Specific objectives:

The specific objectives are indicated in the attached table. Also, for each specific objective, the required instructor actions and the expected student actions must be indicated, as shown in the same table.

PREREQUISITES:

- *Basic theoretical navigational knowledge*
- *Knowledge of COLREGS*

BRIEFING:

- *Getting acquainted with students.*
- *Introducing bridge exercises during this course.*
- *Explaining a bridge exercise (briefing, training, debriefing).*
- *Pointing out and explaining instrumentation and bridge indicators.*
- *Chart handling and using of charts.*
- *Assessing risk of collision by pelorus.*
- *Explaining different time notations.*

TRAINING MATERIALS:

- *Full bridge simulator (including all the navigational equipment)*
- *Overhead sheets and/or power point presentation*
- *Pelorus*
- *Pilot card (ship's particulars and maneuvering tests)*
- *Chart to be used: BA 1892*

In other cases, these training materials may consist of some aids for a theoretical explanation, for example, a power point presentation.

INITIAL CONDITION OF THE SIMULATOR:

For the first simulation of the exercise, the initial conditions are:

- *Type of ship: Bulkcarrier (90.0 x 14 x 5.7)*
- *Initial position: 50º44.5'N 001º23.8'W*
- *Initial time: 1000 UTC*
- *Initial course: 015 (ground)*
- *Initial speed: 12.0 knots*
- *Engine status: Full Ahead*
- *Correction gyro course: + 1.5º*
- *Tidal stream: 015º 1.0 knots*
- *Wind dir. And speed: W 5 Beaufort*
- *Visibility: > 10 miles*
- *Targets (initial position, course and speed):*
  Ownship 50º44.5N 001º23.8'E 015º 12'; Toledo Bay ...46.4...26.9 013º 19'; NII Colombo ...47.5...23.6 021º 11.5'; Koper Express ...48.0...26.2 015º 9'; Roxanne (fishing vessel) ...52.0...19.8 109º 11'; Esso Atlantic ...59.5...24.3 217º 9'; Smit Lloyd 115 (tug) ...52.4...25.8 015º 3'; Ever Trade ...41.5...24.7 011º 16'; Tow 1 ...52.0...25.6 015º 3'; Quiberon ...44.6...34.0 283º 15'; Barraganul ...45.0...31.0 282º 12'; Horsa 51º03.6'N...23.1 148º 18'

Note that if the instructor does not take care in keeping the specified initial conditions, the exercise will not simulate the required condition. For example, let's take two vessels involved in a risk of collision with a determinate wind and sea state. If this condition is not introduced or it is altered, the speeds of both ships will be different, and they may not be involved in the required risk of collision situation.

STUDENT AND INSTRUCTOR ACTIONS:

Student action:

- *During briefing: attending the lecture and explaining the use of simulators and voyage planning.*
- *During exercise: explaining a bridge inventory, familiarizing and trying out a full mission bridge simulator, according to the points of the added schedule in the simulation below.*

Instructor action:

- *Before starting the simulation, explaining simulator inventory.*
- *Before handing over the watch pointing out the traffic.*
- *Monitoring and observing students and ascertaining whether objectives are met.*
- *Monitoring and observing if a natural task division develops.*
- *Monitoring conversations in relation to the later explained SMCP.*
- *Staying on bridge when requested by students.*
- *Observing and noting social order in group.*

DURATION AND TIMETABLE:

- *Briefing: 30 minutes, with the contents above detailed.*
- *Simulator run: 60 minutes, with two simulations: Dover Strait and TSS off Boulogne*
- *Debriefing: 30 minutes, with the contents below explained.*

SIMULATOR RUN. *The schedule of the two simulations is provided as an example and guide of all aspects that must be taken into account during the simulation. Note that, as previously indicated, the skills and times are very well determined, and also the required instructor actions and expected students actions.*

DEBRIEFING/EVALUATION. *After the simulation, a discussion of the exercise is required, specially of those aspects students had problems with or of improper actions. For this exercise, the points of the debriefing are:*

- *Reiterating objectives and checking if they are met.*
- *Pointing out positive actions.*
- *Starting a discussion by means of peer view.*
- *Playing back the exercise and discussing ship's movements.*
- *Summarizing students' actions and conclusions.*
- *Discussing points for improvement.*

Part E. Evaluation and assessment

Introduction

The effectiveness of any evaluation depends on the accuracy of the description of what is to be measured. The learning objectives that are used in the detailed teaching syllabus, Column 3 – Methods for demonstrating competence, and Column 4 – Criteria for evaluating competence, in table A-II/1 of the STCW Code, establish the methods and criteria for evaluation. From these methods, there is a selection of those which can be assessed by simulator. According to the competences of the Code and to the structure of this course, there are six Subject Areas to be evaluated in a three-hour period.

Objective

The learning objectives that are used in the detailed teaching syllabus will provide a sound basis for the construction of suitable simulations/tests for evaluating trainee progress.

Those who successfully complete this course should be able to demonstrate sufficient knowledge, skill and understanding of the competences (that can be evaluated by simulator) described in the table A-II/1 of the STCW Code, as amended. This knowledge, skill and understanding should be included in column 1 of table A-II/1:

Navigation

- Planning and conducting a passage and determining position
- Maintaining a safe navigational watch
- Using radar and ARPA for a safe navigation
- Using ECDIS for a safe navigation
- Responding to emergencies
- Responding to distress signals at sea
- Transmitting and receiving information by visual signaling
- Maneuvering the ship

Cargo handling and stowage

- Monitoring the loading, stowage, securing and unloading of cargoes and their care during the voyage
- Inspecting and reporting defects and damage to cargo spaces, hatch covers and ballast tanks

Controlling the operation of the ship care for persons on board:

- Maintaining the ship's seaworthiness

Instructors should refer to these when designing the assessment of each competence of this CoC.
It is consistent with the intent of the STCW that demonstration of skills and practical understanding be determined by direct observation, while knowledge and theoretical understanding be determined through written examination with a variety of question types.
One option is to consider these written examinations not in the evaluation session, but in the briefings and debriefings as the sum of different short tests for assessing different skills/knowledge. On the other hand, the time for the evaluation should be 2 hours for a complete simulation of all competences required for this CoC, and one hour for the assessment of the theoretical knowledge.

Assessment Planning

The training and assessment of seafarers required under the Convention are administered, supervised and monitored in accordance with the provisions of Regulation I/6 of the STCW Convention.

Assessment planning should be specific, measurable, achievable, realistic and time bound (SMART). Some methods of assessment that could be used depending upon the course/ qualification are as follows and all should be adapted to suit individual needs:

- observation (in oral examination, simulation exercises, practical demonstration);
- questions (written or oral);
- tests;
- simulation.

According to the objective of this CoC, notwithstanding the additional methods for assessing the above competences, the main assessment method is based on simulations, using all simulators where trainees have worked.

Validity

The evaluation methods must be based on clearly defined objectives, and must truly represent what is meant to be assessed; e.g. only the relevant criteria and the syllabus or course guide. There must be a reasonable balance between the subject topics involved and also, in the testing of trainees' KNOWLEDGE, UNDERSTANDING AND PROFICIENCY of the concepts.

Reliability

Assessment should also be reliable (if the assessment was done again with a similar group/learner, similar results would be achieved). Different groups of learners may have the same subject at different times. If other evaluators are also assessing the same course/qualification, it is necessary to ensure that all are making the same decisions. In order to be reliable, an evaluation procedure should produce reasonably consistent results, no matter which set of papers or version of the test is used.

If instructors are assessing their own trainees, they need to know what to assess and then decide how to do this. The "what" will come from the standards/learning outcomes of the course/qualification they are delivering and the "how" may be decided whether it is with assignments, tests or examinations.

The instructors need to consider the best way to assess the skills, knowledge and attitudes of their learners, whether this will be formative and/or summative and the validity and reliability of the assessment. As it has been indicated, for this CoC, the main assessment method is based on simulations, using all simulators where trainees have worked. Notwithstanding, other methods shall apply.

All work assessed should be valid, authentic, current, sufficient and reliable; this is often know as VACSR – "valid assessments create standard results":

- valid: the work is relevant to the standards/criteria being assessed;
- authentic: the work has been produced solely by the learner;
- current: the work is still relevant at the time of assessment;
- sufficient: the work covers all the standards/criteria;
- reliable: the work is consistent across all learners, over time and at the required level.

It is important to note that no single method can satisfactorily measure knowledge and skill over the :trum of topics to be tested for the assessment of competence. Therefore, care should be

taken to select the most appropriate method to the particular aspect of competence to be tested, bearing in mind the need to frame questions which relate as realistically as possible to the requirements of the officer's tasks at sea.

Compiling assessments

Whilst each examining authority establishes its own rules, the time which can be devoted to assessing the competence of candidates for certificates of competency is limited by practical, economic and social restraints. Therefore a prime objective of those responsible for the organization and administration of the assessment system is to find the most efficient, effective and economical method of assessing the competency of candidates. An examination system should effectively test the depth of a candidate's KNOWLEDGE, UNDERSTANDING AND PROFICIENCY of the subject areas pertinent to the tasks he/she is expected to undertake. It is not possible to examine candidates fully in all areas, so in effect the assessment samples a candidate's KNOWLEDGE, UNDERSTANDING AND PROFICIENCY by covering a scope as wide as possible within the time constraints for testing his/her depth of KNOWLEDGE, UNDERSTANDING AND PROFICIENCY in the selected areas.

Thus, in the 3 hours devoted to evaluation, the simulations shall ensure the candidate's knowledge, understanding and proficiency of all the subject areas defined which correspond to the STCW Code competences.

The assessment as a whole should assess each candidate's comprehension of principles, concepts and methodology; ability to apply principles, concepts and methodology; ability to organize facts, ideas and arguments and abilities and skills in carrying out the tasks to perform the duties he or she is to be certificated to undertake.

All evaluation and testing techniques have their advantages and disadvantages. Examining authorities should carefully analyse what they should test and could test. A careful selection of test and evaluation methods should then be made to ensure that the best from the variety of techniques available today is used. Each assessment shall be that which best suits the learning outcome or the ability to be assessed.

Quality of test items

No matter which type of test is used, it is essential that all questions or test items used should be as brief as possible, since the time taken to read the questions themselves lengthens the examination. Questions must also be clear and complete. To ensure this, it is necessary to do peer review. Furthermore, no superfluous information should be incorporated in the questions.

Exam-exercise

In the assessment planning, it has been established that the main method for assessing competences is the use of simulators. Then, for an exam model, it is necessary to specify:

- Subject Area time
- Subject Area contents
- Subject Area simulator/s

Depending on the time available, maybe not all items of each competence should be evaluated, but as it has been indicated in the Compiling assessments, the simulations must guarantee the candidate's knowledge, understanding and proficiency on all subject areas defined, in order to ensure that the main competences of the STCW Code are assessed.

The exam shall be a sum of shorter exercises. For example: a ship is sailing and some situations occur; then, this ship berths, and when berthed, she discharges her cargo and she is going to load another

cargo; then, in one of these operations, an emergency occurs. The different situations shall provide a wide range of exam exercises. It is important to have a variety of exams, which correspond to different situations so that the student *can* randomly choose one of them.

For the competences which cannot be evaluated in a simulation session, three possibilities should be considered:

- During the briefings and debriefings, different short tests for assessing different skills/knowledge should be proposed. The sum of all of these short exams should provide a complete exam for all these competences.
- Some time should be devoted to the evaluation by simulator (for example 2 or 2.5 hours) and the rest of time to the assessment of the theoretical knowledge (1 or 0.5 hours).
- Some theoretical questions should be incorporated in the exam-exercises, during the simulation and between two *expected student actions*, could ask some of the questions found during the simulation.

Annex I. Example Scenario

In the following pages, we attach an example scenario considering Part D. Instructor Manual section:

Course: **COC Revalidation Course**

Title: TSS, approaching Hinder Junction, northeast bound during night time.
Own Ship: Bulkcarrier

Exercise nr: Operational. 3.1

References:
- Bridge Watchkeeping (Nautical Institute ISBN 1870077172)
- Bridge Team Management (Nautical Institute ISBN 1870077660)
- Mariners Handbook.
- Collision Regulations (COLREGS).
- STCW: Table AII/1 c1-1, c1-2, c1-3, c1-4

Duration:
- Briefing: 30 minutes.
- Simulator run: 60 minutes.
- Debriefing: 30 minutes.

Objectives /Competences:

This exercise trains the student with:
- To plan and conduct a passage and determine position.
- Maintain a safe navigational watch.
- Use of radar and ARPA to maintain the safety of navigation.
- Use of ECDIS to maintain the safety of navigation.

Prerequisites:
- Basic theoretical navigational knowledge.
- Knowledge of COLREGS.

Training materials:
- Full Mission Bridge Simulator (including all the navigationalequipment).
- Overhead sheets and/or PowerPoint presentation.
- Pilot card (ship's particulars and manoeuvring tests).
- Chart to be used: BA 323 and BA 1630.

Initial condition simulator:
- Type of ship: Bulkcarrier (215.4 * 31.8 * 11.5).
- Initial position: 51°13'.5 N, 002°04'.0 E.
- Initial time: 01.00. (MET)
- Initial course: 025° (ground).
- Initial speed: 15.9 knots.
- Engine status: full sea speed
- i.c. gyro course: + 1.0°.
- Tidal stream: 050°@1.5kn
- Wind dir. and speed N 5 Bft.
- Visibility: > 10M.
- Targets: see target list.
- Radar: on.

Target ships in exercise:	Position:	Course/speed:
Willem Barentsz	51°13'.5 N, 002°04'.0 E	025° / 15.9
Norasia Herenveen	51° 10‘0 N 001° 54‘6 E	059° / 20
Ever Ocean	51° 14‘5 N 002° 04‘0 E	017° / 21
Espirit	51° 22‘2 N 002° 27‘0 E	251° / 18.9
Porto Colon	51° 15‘8 N 001° 53‘4 E	031° / 10
Katwijk	51° 11‘7 N 002° 01‘1 E	060° / 18
Belga Gent	51° 20‘0 N 002° 15‘0 E	295° / 8
FO 221 (Fishing Vessel)	51° 09‘2 N 002° 04‘0 E	053° / 5
BL 342 (Fishing Vessel)	51° 17‘0 N 002° 02‘2 E	233° / 4
FO 220 (Fishing Vessel)	51° 09‘2 N 002° 04‘0 E	063° / 10
Nedlloyd Nile	51° 14‘1 N 002° 04‘7 E	025° / 19
Ever Star	51° 23‘4 N 001° 59‘5 E	123° / 12
Prins Laurant	51° 11‘0 N 002° 18‘1 E	028° / 22.5
Zim Genova	51° 12‘4 N 001° 58‘0 E	063° / 17
Jindai Maru	51° 15‘0 N 002° 07‘0 E	022° / 10
P&O Kopenhagen	51° 24‘9 N 001° 54‘7 E	127° / 10
Berge Chroom	51° 19‘3 N 002° 04‘0 E	100° / 12
Norasia Shanghai	51° 22‘7 N 002° 30‘9 E	251° / 15

Briefing:

- Answering questions about previous exercise.
- Determine the ship's position by radar, GPS, DR or by sight.
- Knowledge of and ability to use the nautical chart, tide tables, sailing directions and ship's routeing information.
- Ability to use equipment, such as Echo-sounders, and apply the information correctly.
- Knowledge of the principles of magnetic and gyro-compasses
- Interpretation of the meteorological aspects.
- Knowledge of steering control systems, operational procedures and changeover from manual to automatic control.
- Knowledge of the International Regulations for Preventing Collisions at sea.
- Principals of keeping a navigational watch.
- Use of routeing vessels in accordance with the General Provisions of Ship's Routeing
- Information from navigational equipment for maintaining a safe watch.
- Use of reporting in accordance with Ship Reporting Systems and VTS procedures.
- Knowledge of blind pilotage techniques.
- Knowledge of Bridge Resource Management principles.
- Knowledge of fundamentals of radar and automatic radar plotting aids.
- Ability to operate and to interpret and analyse information obtained from radar / ARPA.
- Knowledge of the capability and limitations of ECDIS operations.

Student action:

- Attend lecture.
- Prepare sailing plan in briefing.

- Monitor and understand the instrument reaction on the sailing ship.
- Visually and automatically acquire targets, determine the risk of collision by bearing and react according to COLREGS.
- Taking visual and radar bearings to determine ship positions.
- Acquire and process GPS positions.

Instructor action:

- Before handing over the Watch point out the traffic.
- Monitor and observe students and ascertain if objectives are met.
- Monitor conversations in relation to the later explained SMCP.
- Stays on bridge when requested by students.
- Deal with all targets according to COLREGS.

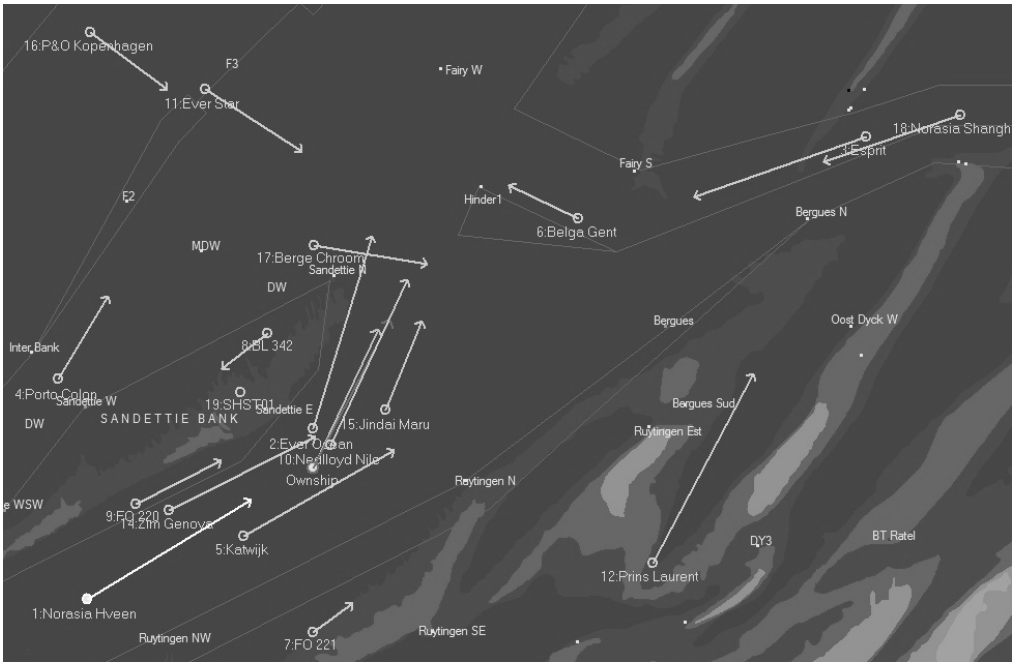
Debriefing:

- Reiterate objectives and check if they are met.
- Point out positive actions
- Start a discussion by means of peer review.
- Playback the exercise and discuss ship's movements
- Summarise students' actions and conclusions.
- Discuss points for improvement.
- Check if positions are properly noted in the chart(s).

Evaluation:

Check if the students:

- Are capable of sailing the ship.
- Have a clear understanding of basic navigation.



Operational level exc. OP. 3-1 (Watchkeeping)

A	B	Particulars	Expected student action	Expected action instructor	Text	Instructor guidelines
		Exercise philosophy: A night exercise. They meet the vessel Jindai Maru with engine trouble. Especially at the end of the exercise the situation becomes complex. The best thing to do is to slow down. But you have to anticipate on that in due time. To give notice to engine room is easy forgotten!				
-05:00	--	Preparing the bridge for the coming exercise.	Each student checks and prepares own instruments. AWO inserts PI lines.	**Switch on steering light of O.S.** Checking if all instruments are set properly. The HOW does not have a radar.		
-03:00	--	Handing Over of the Watch	Apprehend watch hand over	HOW, WO and AWO are handed over their task specific watch particulars	Check if relieving officers are fully capable of performing their duties, particularly their adjustment to night vision.	Explain why the ECDIS and radar do have a night presentation
00:00	025/15.0		WO plotting other ships. AWO using PI-lines and plotting the coming waypoint.	Check current=055°@1.4kn Check wind= 000° -15kn Check waves= 000° - 1.5m Monitor decision-making or the lack thereof.		
+06:00	025/15.0	VHF message received	WO listens to VHF message AWO plots the position mentioned in the VHF message in the chart and relate to radar image and outside view.	Transmit VHF message VHF01	VHF01: *Securité 3x, this is "Jindai Maru" JAPY 3x, I am having engine troubles and not under control. Position 3.6m NE of Sandettie E. buoy. Plse given me a wide berth*	Slow down J.M. Switch navigation lights accordingly (N.U.C)
+07:00	025/15.0			Transmit VHF message VHF02	VHF02: *Jindai Maru 3x this is Griz Nez Traffic control how do you read?* *GN Traffic control this is JM read you loud and clear. etc.*	O.S. should be aware
+07:30	025/15.0		WO and HOW locate Jindai Maru			
+10:00	025/15.0	VHF message received	WO listens to VHF message, informs HOW / AWo about contents of message	Transmit VHF message VHF03 16 Transmit VHF message VHF04 69	VHF04: *Hello All ships, all ships, all ships, this is Griz Nez Traffic Control etc*	

Operational level exc. OP. 3-1 (Watchkeeping)

A	B	Particulars	Expected student action	Expected action instructor	Text	Instructor guidelines
+11.00	025/15.0		AWO checks the positions mentioned in the CNIS message in the chart and WO relates to radar image and outside view.			
+12:00	025/15.0	Belga Gent, now within 6M range, crossing NE lane in a few minutes	WO plots Belga Gent.			
+13:00	025/15.0	CPA of Belga Gent ≈ 0.75 M	WO warns HOW about CPA of Belga Gent.			
+18:00	025/15.0	Waypoint, Sandettie-N buoy abeam	AWo warns HOW about reaching waypoint			
+18.30	025/15.0		HOW consults WO about course change.			When O.S. keeps course and speed, B.G. will pass the bow of O.S.
+20:00	010/15.0	Espirit passes waypoint, starts crossing course of O.S., CPA becomes small.				
+21:00	010/15.0	Espirit has small CPA	WO starts plotting Espirit when in range.			
+21:30	010/15.0		WO warns HOW about CPA of Espirit.			
+22:00	010/15.0		If decided to slow down Engine room should be given a call. Give Engine Room 5 min. notice.			

Operational level exc. OP. 3-1 (Watchkeeping)						
A	**B**	**Particulars**	**Expected student action**	**Expected action instructor**	**Text**	**Instructor guidelines**
+27.00	010/15.0	E.R. calls bridge, ready to manoeuver	HOW orders WO to decrease speed			When Espirit comes close, give sound signal.

Column A: Time χ min: sec (before) – or (after) + the start of the exercise.

Column B: Expected gyro course and water speed of own ship.

Annex II

Annex II

SIMULATION -BASED MODEL COURSE (MANAGEMENT LEVEL – DECK DEPARTMENT)

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Foreword

This course has been developed by the International Association of Maritime Universities (IAMU), following the model course structure adopted by the International Maritime Organization (IMO).

Since its inception the IMO has recognized the importance of human resources to the development of the maritime industry and has given the highest priority to assisting developing countries in enhancing their maritime training capabilities through the provision or improvement of maritime training facilities at national and regional levels. IMO has also responded to the needs of developing countries for postgraduate training for senior personnel in administrations, ports, shipping companies and maritime training institutes by establishing the World Maritime University in Malmö, Sweden, in 1983.

Following the adoption of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW Code), a number of IMO Member Governments had suggested that IMO should develop model training courses to assist in the implementation of the Convention and in achieving a more rapid transfer of information and skills regarding new developments in maritime technology. IMO training advisers and consultants also subsequently determined from their visits to training establishments in developing countries that the provision of model courses could help instructors improve the quality of their existing courses and enhance their implementation of the associated Conference and IMO Assembly resolutions.

After the Manila Amendments and the intention of enhancing the training, Governments, shipowners and other parties involved in the maritime trade, have noted the necessity of a worldwide standardization for the training of seafarers, and also the advisability of the use of simulators for a more practical training. In this sense, IAMU has developed this course, trying to assess the revalidation certificates with simulation sessions whenever possible.

In addition, it was appreciated that a comprehensive set of short model courses in various fields of maritime training would supplement the instruction provided by maritime academies and allows administrators and technical specialists already employed in maritime administrations, ports and shipping companies to improve their knowledge and skills in certain specialized fields. With the generous assistance of the Government of Norway, IMO developed model courses in response to these generally identified needs and now keeps them updated through a regular revision process taking into account any amendments to the requirements prescribed in IMO instruments and any technological developments in the field.

Introduction
Purpose of the model courses

As the intention of this revalidation course is to follow the standards of the IMO model courses, IAMU also agrees with the purposes of the IMO model courses.

The purpose of this revalidation simulation-based model course is to assist maritime training institutes and their teaching staff in organizing and introducing new training courses or in enhancing, updating or supplementing existing training material where the quality and effectiveness of the training courses may thereby be improved. Only those competences relating to ships bridge simulators will be considered for the model course scenario development and testing.

It is not the intention of the model course program to present instructors with a rigid “teaching package” which they are expected to “follow blindly”. Nor is it the intention to substitute audio- visual or “programmed” material for the instructor’s presence. As in all training endeavours, the knowledge, skills and dedication of the instructor are the key components in the transfer of knowledge and skills to those being trained through IMO model course material.

Because educational systems and the cultural backgrounds of trainees in maritime subjects vary considerably from country to country, the model course material has been designed to identify the basic entry requirements and trainee target group for each course in universally applicable terms, and to specify clearly the technical content and levels of knowledge and skill necessary to meet the intent of IMO conventions and related recommendations.

Use of the model course

To use the model course the instructor should review the course plan and detailed syllabus, taking into account the information provided under the entry standards specified in the course framework. The actual level of knowledge and skills and the prior technical education of the trainees should be kept in mind during this review, and any areas within the detailed syllabus which may cause difficulties because of differences between the actual trainee entry level and that assumed by the course designer should be identified. To compensate for such differences, the instructor is expected to delete from the course, or reduce the emphasis on, items dealing with knowledge or skills already attained by the trainees. He should also identify any academic knowledge, skills or technical training which they may not have acquired.

By analyzing the detailed syllabus and the academic knowledge required to allow training in the technical area to proceed, the instructor can design an appropriate preentry course or, alternatively, insert the elements of academic knowledge required to support the technical training elements concerned at appropriate points within the technical course.

Adjustment of the course objectives, scope and content may also be necessary if in your maritime industry the trainees completing the course are to undertake duties which differ from the course objectives specified in the model course.

Within the course plan the course designers have indicated their assessment of the time that should be allotted to each learning area. However, it must be appreciated that these allocations are arbitrary and

assume that the trainees have fully met all entry requirements of the course. The instructor should therefore review these assessments and may need to re-allocate the time required to achieve each specific learning objective.

Lesson Plans

Having adjusted the course content to suit the trainee intake and any revision of the course objectives, the instructor should draw up lesson plans based on the detailed syllabus. The detailed syllabus contains specific references to the textbooks or teaching material proposed for use in the course. Where no adjustment has been found necessary in the learning objectives of the detailed syllabus, the lesson plans may simply consist of the detailed syllabus with keywords or other reminders added to assist the instructor in making his presentation of the material.

Presentation

The presentation of concepts and methodologies must be repeated in various ways until the instructor is satisfied that the trainee has attained each specified learning objective. The syllabus is laid out in learning-objective format and each objective specifies what the trainee must be able to do as the learning outcome.

Implementation

For the course to run smoothly and to be effective, considerable attention must be paid to the availability and use of:

- Properly qualified instructors
- Support staff
- Rooms and other spaces
- Main equipment: **simulators**
- Charts and nautical publications
- Other supporting material as teaching aids, such as video tutorial or power points
- Other reference material

Thorough preparation is the key to successful implementation of the course. IMO has produced “Guidance on the Implementation of IMO Model Courses,” which deals with this aspect in greater detail and is included as an attachment to this course; and IAMU has also adopted this IMO Guide.

Part A: Course Framework

Scope

This course intends to provide a guide for all maritime training institutes and Government requirements for the renewing of the professional certificate for Master or Chief Mate, according to STCW requirements, as revised by the 2010 Manila amendments, specifically as these apply to table A-II/2, knowledge, skill and understanding of all competences that may be assessed by simulation.

Thus, this course is not the whole course for renewing the professional certificate for Master or Chief Mate, but it is the part which may be assessed by simulation. Therefore, it should be understood that this is a generic course which requires a structured and complementary with other competences described in the tables A-II/2 of the STCW Code that cannot be assessed by simulation.

Notwithstanding, this course intends to assess all competences of the table A-II/2 that may be evaluated by using a simulator.

Objective

Those who successfully complete this course should be able to demonstrate sufficient knowledge, skill and understanding of the competences described in the table A-II/2 of STCW Code, as amended. This knowledge, skill and understanding should include Column 1 of Table A-II/2:

Navigation:

- Plan a voyage and conduct navigation
- Determine position and the accuracy of resultant position fix by any means
- Determine and allow for compass errors
- Coordinate search and rescue operations
- Establish watch keeping arrangements and procedures
- Maintain safe navigation through the use of navigation equipment and systems to assist command decision-making
- Maintain the safety of navigation through the use of ECDIS and associated navigation system to assist command decision-making
- Maneuver and handle a ship in all conditions
- Operate remote controls of propulsion plant and engineering systems and services (20)

Cargo handling and stowage:

- Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes
- Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action
- Carriage of dangerous cargoes

Controlling the operation of the ship care for persons on board:

- Control trim, stability and stress
- Monitor and control in compliance with legislative requirements and measures to ensure the safety of life at sea and the protection of the marine environment
- Use leadership and managerial skills

Entry Standards

The trainees of this course shall be those deck officers whose professional certificate has expired, as they have not sailed a minimum of twelve month during the last five years or three months during the last year.

Therefore, it is assumed that trainees undertaking this course have accomplished some formal instruction in terrestrial navigation, have at least some familiarization with visual navigation, have accomplished a period of supervised bridge watch-keeping duties, and have prior completion of basic Radar/ARPA (MC 1.07). Trainees should also have considerable familiarization with personal computing operating systems, keyboards and mice/trackballs.

Course Certificate

Documentary evidence should be issued to those who have successfully completed this course indicating that the holder has completed his/her training and has been evaluated for this course.

This certificate shall accredit that the holder has demonstrated the knowledge, skills and understanding of the mentioned competences required by the STCW Code for his/her capability to exercise as Master or Chief Mate.

Notwithstanding, the holder shall complete his/her trainee with the rest of the competences which are not assessed by simulator.

Course delivery

The outcome of this course is structured in seven groups of exercises or general subject areas, which assess and evaluate at the same time more than one competence. These groups or subject areas are:

1. Familiarization with the different kinds of simulators
2. Planning a voyage
3. Watchkeeping
4. Manoeuvering
5. Cargo handling for different kinds of ships
6. Emergencies and rescue
7. Controlling the operations of the ship and care on board

Moreover, methods of distance learning or computer-based training may be used to provide familiarization with the contents of this course, but should not be substituted for the underway assessment of proficiency.

Course intake limitations

The maximum number of trainees should depend on the facilities and equipment available, bearing in mind the scope and objectives of this course.

The instructor – trainee ratio should be limited to 1:12. When a class size exceeds 12 trainees, an assistant instructor is required.

Staff requirements

The following are the minimum qualifications recommended for instructors delivering a course that follows the IMO Model Course 1.27, 3.12 and 6.10. The instructor in charge should:

- Hold relevant certificate of competency in the deck department or other qualification or experience at the discretion of the administration approving the course;
- Hold the Certificate of General Operator of the Global Maritime Distress and Safety System;
- Hold the Certificate of Automatic Radar Plotting Aids (ARPA);
- Have successfully completed an approved ECDIS course;
- Have completed type specific familiarization relevant to the equipment used for training;
- Have a detailed knowledge of the requirements of SOLAS chapters V/2, V/19, and V/20-27, as amended;
- Have an up-to-date knowledge of the IMO ECDIS Performance Standards currently in force and knowledge of relevant STCW requirements and guidance;
- Have an up-to-date knowledge of ENCs;
- Be fully aware of current ENC data transfer standards and presentation libraries of the IHO, methods of ENC licensing and updating and current IMO recommendations on ECDIS software and other issues;
- Have a current relevant teaching qualification or have successfully completed a Train-The-Trainer course, including the application of simulators in training and meets the requirements of STCW regulation I/6 and I/12.

Assistant instructors should have relevant knowledge of ECDIS operation.

Teaching Facilities and equipment

As indicated below, in Teaching Aids, this course has plenty of teaching facilities and equipment, but the main equipment for the purpose of this course, is a set of simulators that allow to simulate the required training conditions.

The radar and ship handling simulators are the most well-known and widespread, but it is quite surprising to see which other types of activities and equipment have become models for a maritime training simulator system and have been developed and installed:

- Navigation equipment trainer **(NAV)**
- Communication procedures/GMDSS equipment trainer **(COM)**
- Radar simulator **(RAD)**
- Radar and navigation simulator **(NAV/RAD)**
- Ship handling simulator with/without motion platform/image generation **(SHIP)**
- Crane handling simulator **(CRA)**
- Vessel traffic management simulator **(VTS)**
- Search and rescue management trainer **(SAR)**
- Oil spill management trainer **(SPILL)**
- Cargo handling trainer **(CAR)**
- Ballast control trainer **(BAL)**

This list is not intended to be all-inclusive.

Note: names in brackets and bold, are assigned to refer to each particular type of simulator later on.

In addition to the trainee work stations there must be an instructor station with dedicated projection system that will allow projection of the exercises and lecture materials. It is strongly recommended that there be display(s) networked to the instructor station, thereby allowing display(s) of ARPA and ECDIS information (or other training material) for the benefit of the trainees.

Note that the lecturing may take place in the same room as the simulation if the space is suitable. This would require adequate visibility around/over the workstations to the whiteboard/chalkboard and projection screens, and adequate work space for taking notes and written examinations.

Briefing and Debriefing sessions

The debriefing session is a vital phase of a simulation, since this is when consolidation of lessons learned is accomplished. An atmosphere of candour must be encouraged, while participants take responsibility for assessing actions and results of decisions made during simulation.

While one group is using the simulator the other group should be debriefed on the previous exercise and briefed on the following one. When a group finishes the day with an exercise, it is preferable to extend the session to include the debriefing while the exercise is still fresh in the trainees' minds rather than to postpone it until the following day.

The time spent on debriefing will vary from exercise to exercise and should occupy between 25 and 30 per cent of the total time used for simulator exercises.

Various facilities may be used to assist in debriefing, such as playback (in which the whole exercise is recorded and any sequence is available for discussion), plotters (which record the tracks made by the ships), data-logging equipment and voice recorders.

Teaching aids (A)

A1: Different kinds of simulators
A2: Instructor Manual (Part D of the revalidation course)
A3: Nautical charts and publications

- Catalogue of British Admiralty Charts and other Hydrographic Publications
- British Admiralty Notices to Mariners
- Charts
- British Admiralty List of Lights
- National List of lights and Buoyage System
- British Admiralty Tide Table of the area concerned
- National tide table
- British Admiralty Sailing Directions for the area concerned
- National sailing directions
- The Mariner's Handbook (NP100)
- Ocean Passages for the World (NP136)
- Nautical Almanac
- Pilot chart of the ocean concerned (US Hydrographic Office publication)
- Ocean plotting sheet

- British Admiralty List of Radio Signals
- Ship's Log-book
- Pre-compute altitude and azimuth table
- Sight Reduction Tables for Navigation AP 3270 Vol. 1

A4: Audiovisual aids: video tutorial, power point, auto-test, etc.
A5: Records of the simulations
A6: Other specific material, such as sextant and azimuth mirror

Bibliography (B)

B1 NMEA Interface Standard 0183 v.4.10. Severna Park, MD: National Marine Electronic Association, 2008

B2 Facts about electronic charts and carriage requirements, S-66, 1.0.0 Ed. Monaco: International Hydrographic Bureau, 2010

B3 Gale, H. From Paper Charts to ECDIS. London: Nautical Institute, 2009

B4 Bole [et al.]. Ancillary Equipment (Chapter 10). A: The Radar/ARPA Manual. Amsterdam: Elsevier, 2013. ISBN 978-0-08-097752-2.

B5 Electronic Charts (Chapter 14). A: American Practical Navigator: Pub. No.9. Bethesda, Ma.: NIMA, 2002.

B6 Simulator reference manual (Manufacturer, Date)

B7 User's manual accompanying the ECDIS software utilized during the training course

B8 IEC 61174: Maritime navigation and radiocommunication equipment and systems – Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results, Edition 3.0, International Electrotechnical Commission, 2008. ISBN 978-2-88910-432-1

B9 IHO Special Publication No 66: Facts about electronic charts and carriage requirements, Edition 1.0. Monaco: International Hydrographic Organization, 2010

B10 IHO S-61: Product specifications for Raster Navigational Charts (RNC), Edition 1.0. Monaco: International Hydrographic Organization, 1999.

B11 IHO S-52: Specifications for chart content and display aspects of ECDIS, Monaco: International Hydrographic Organization, 2010.

B11B S-52 Chart Presentation Bulletins (CPB)

B12 IHO S-100: Universal Hydrographic Data Model, Ed. 1.0.0. Monaco: International Hydrographic Organization, 2010.

B13 IHO S-57: IHO Transfer Standard for Digital Hydrographic Data, Edition 3.1. Monaco: International Hydrographic Organization, 2000.

B14 Dutton's Nautical Navigation, 15th ed. Naval Institute Press, 2003. 978-1557502483

B15 Burger, W. Radar Observer's Handbook for Merchant Navy officers, 9th Revised Ed. Glasgow: Brown, Son and Ferguson, 1999. ISBN 978-0851746661.

B16 Crane, C.L. Maneuvering Trials of the 278,000 DWT Esso Osaka in Shallow and Deep Waters: Marine Research Program. Report Number EII. 4TM. 79. Exxon International Company Tanker Department - Research and Development, 1979.

B17 Barrass, C.B. Ship Squat and its Calculation. Safety at Sea, February 1978, No. 107, p.11

B18 Cahill, R.A. Collisions and their causes. London: The Nautical Institute, 2002. ISBN 978-1-870077-60-6

B19 Cahill, R.A. Strandings and their Causes. London, Fairplay Publications, 1985. ISBN 0-905045-60-2
B20 Norrbin, N.H. Bank effects on a ship moving through a short dredged channel. A: Proceedings of the 10th Symposium on Naval Hydrodynamics in Cambridge, Mass., March 1974.
B21 Paffett, J.H.A. Ships and Water. London: The Nautical Institute, 1990, ISBN 1-870077-06-7
B22 SAS Flight Academy, Dutch Maritime Pilots' Corporation, National Board of Navigation, Finland, National Maritime Administration, Sweden, Norwegian Shipowner's Association, Silja Line AB, Swedish Club, Swedish Shipowner's Association, Bridge Resource Management Student's Workbook.
B23 International Health Regulations, 2nd Edition, Ginebra: World Health, 2005, ISBN 978-92-4-158041-0

IMO references (R)

R1 Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW Convention), as amended, 2011 Edition, IMO
R2 International Convention for the Safety of Life at Sea, 1974, as amended (SOLAS), Consolidated Edition 2009, IMO
R3 Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREG 1972), Consolidated Edition 2003, IMO
R4 Model Course 7.01 – Master and Chief Mate, 1999 Edition, IMO
R5 Model Course 1.22: Ship Simulator and Bridge Teamwork, 2002 Edition, IMO
R6 Assembly Resolution A.893(21) - Guidelines for Voyage Planning, IMO
R7 Ship's Routeing, 2010 Edition, IMO
R8 Adoption of the Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS), MSC. 232(82), 2006 Edition, IMO
R9 Assembly Resolution A.817(19) - ECDIS Performance Standards
R10 Resolution MSC.1/Circ.1391, Operating anomalies identified within ECDIS, 2010
R11 SN.1/Circ.266/Rev. 1, Maintenance of Electronic Chart Display and Information System (ECDIS) Software, 2007
R12 Assembly Resolution A.665(16), – Performance Standards for Radio Direction-Finding, 1989.
R13A Assembly Resolution A.224(VII) – Performance Standards for Echo-Sounding
R13B Resolution MSC.74(69): Annex 4 Recommendation on performance standards for echo-sounding equipment, 1998
R14A Assembly Resolution A.478(XII) – Performance Standards for Device to Indicate Speed and Distance
R14B Assembly Resolution A.824(19) – Performance standards for devices to measure and indicate speed and distance
R14C Resolution MSC.96(72), Adoption of amendments to performance standards for devices to measure and indicate speed and distance, 2000
R15A Assembly Resolution A.342(IX) – Recommendation on Performance Standards for Automatic Pilots
R15B Resolution MSC.64(67) : annex 3, Recommendation on performance standards for heading control systems
R16A Assembly Resolution A.706(17) – World-Wide Navigational Warning Service
R16B IMO MSC.1/Circ.1288, Amendments to resolution A.706(17) – World-wide navigational warning, service, 2008

R17 International Code of Signals
R18 Assembly Resolution A.954(23) – Proper Use of VHF Channels at Sea
R19 International Aeronautical and Maritime Search and Rescue Manual (IAMSAR Manual), 2013 Edition, IMO
R20 Assembly Resolution A.889(21) - Pilot transfer arrangements
R21A Assembly Resolution A.601(15) – Provisions and display of Manoevering
R21B Assembly Resolution A.751(18) - Interim standards for ship manoeuvrability. (Annex superseded by annex to MSC.137(76))
R22 Assembly Resolution A.953 (23) - World-wide radionavigation system.
R23 Assembly Resolution A.577 (14) - Operational Status of Electronic Position-Fixing Systems
R24 Assembly Resolution A.280 (VIII) – Recommendations on Performance Standards for Gyro-Compasses
R25 Assembly Resolution A.382(X) – Magnetic Compasses: Carriage and Performance Standards
R26A Assembly Resolution A.422(XI) – Performance Standards for Automatic Radar Plotting Aids (ARPA) (Amended by A.823(19))
R26B Assembly Resolution A.823(19) - Performance standards for automatic radar plotting aids (ARPAs)
R26C Resolution MSC.192(79), Adoption of the revised performance standards for radar equipment, 2004
R27 Assembly Resolution A.424(XI) – Performance Standards for Gyro-Compasses
R28 Assembly Resolution A.694(17) - General Requirements for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System (GMDSS) and for Electronic Navigational Aids
R29 Assembly Resolution A.528(13) – Recommendation on Weather Routeing
R30 International Convention for the Prevention of Pollution from Ships, 1973/78 (MARPOL), Consolidated edition 2011, IMO.
R31A International Maritime Dangerous Goods Code (IMDG Code), 2012 Edition, IMO
R31B IMDG Code Supplement, 2010 Edition, IMO
R32 IMO Dangerous Goods Labels, Marks and Signs, 2012 Edition, IMO
R33 Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG)
R34 Emergency Procedures for Ships Carrying Dangerous Goods (EmS)
R35 International Maritime Solid Bulk Cargoes Code (IMSBC Code) and Supplement, 2013 Edition, IMO
R36 Resolution MSC.137(76), Standards for ship manoeuvrability, 2002
R37 Assembly Resolution A. 714(17) - Code of Safe Practice for Cargo Stowage and Securing
R38 Assembly Resolution A.489(XII) – Safe Stowage and Securing of Cargo Units and Other Entities in Ships Other than Cellular Containers Ships
R39 Assembly Resolution A.533(13) – Elements to be taken into account when considering the Safe Stowage and Securing of Cargo Units and Vehicles in Ships
R40A Assembly Resolution A.581(14) – Guidelines for Securing Arrangements for the Transport of Road Vehicles on Ro-Ro Ships (Amended by MSC/Circ.812)
R40B IMO MSC/Circ.812, Amendments to Assembly Resolution A.581(14) – Guidelines for Securing Arrangements for the Transport of Road Vehicles on Ro-Ro Ships, 1997
R41 International Code for the Safe Carriage of Grain in Bulk (International Grain Code), 1991 Edition, IMO
R42 International Conference on Load Lines, 1966, 2005 Edition, IMO

R43A Assembly Resolution A.760(18) - Symbols related to life-saving appliances and arrangements. Amended by MSC.82(70)
R43B Resolution MSC.82(70), Amendments to resolution A.760(18) on symbols related to life-saving appliances and arrangements, 1998
R44 Assembly Resolution A.921(22) - Assembly resolutions superseded by the 1995 amendments to the 1978 STCW Convention
R45 International Conference on Special Trade Passenger Ships Agreement, 1971, 1972 Edition, IMO
R46 Protocol on Space Requirements for Special Trade Passenger Ships, 1973, (SPACE STP 1973), IMO
R47 Athens convention relating to the Carriage of Passengers and their Luggage by Sea, 1974 (PAL 1974), IMO
R48 International Convention on Tonnage Measurement of Ships, 1969, IMO
R49 Assembly Resolution A.769(18) – Procedures and Arrangements for Issuing GMDSS Certificates to Holders of Non-GMDSS Certificates
R50 IMO/ILO Document for Guidance, 1985, IMO
R51 International Safety Management Code (ISM Code) and Guidelines on implementation of the ISM Code, 2010 Edition, IMO
R52 International Life-Saving Appliance (LSA Code), 2010 Edition, IMO

Textbooks (T)

T1 Norris, A. ECDIS and Positioning. London: The Nautical Institute, 2010.
T2 Weintrit, A. The Electronic Chart Display and Information System (ECDIS): An Operational Handbook. Gdynia: Gdynia Maritime University, Poland, Balkema Book, CRC Press, Taylor & Francis Group, 2009.
T3 Hecht [et al.]. The Electronic Chart, Fundamentals, Functions, Data and other Essentials A Textbook for ECDIS Use and Training, 3rd Revised Edition. Lemmer, The Netherlands: Geomares Publishing, 2011.
T4 The ECDIS Manual, ECDIS Ltd, Witherby: Seamanship International, 2012.
T5 The Admiralty Manual of Navigation: Principles of Navigation. London: the Nautical Institute, 2008. ISBN 978-1-870077-90-3.
T6 Emms, Christopher. An introduction to Coastal Navigation: A Seman's Guide. 4th ed. Wooten-under-Edge (UK): Morgans Technical Books, 1985. ISBN 0-948254-02-5.
T7 Boole, A.G.; Dineley, W.O. and Nicholls, C.E.; The Navigation Control Manual. 2nd ed. Oxford: Heinemann Professional, 1992. ISBN 0-7506-0542-1.
T8 Cockroft, A.N.; Lameijer, J.N.F. A Guide to Collision Avoidance Rules, 7th ed. Oxford: Butterworth-Heinemann, 2012. ISBN 978-0080971704.
T9 Frost, A. Practical Navigation for Second Mates, 6th. Ed. Glasgow: Brown, Son & Ferguson, 1985.
T10 Frost, A. The Principles and Practice of Navigation. 3rd. Ed. Glasgow: Brown, Son & Ferguson, 1988. ISBN 0-85174-542-3.
T11 Hooyer, Henry H. The Behaviour and Handling of Ships. Centreville, M.D.: Cornell Maritime Press, 1983. ISBN 0-787033-306-2.
T12 Bridge Procedures guide; 4th ed. London: International Chamber of Shipping, 2007
T13 Peril at Sea and Salvage: A Guide for Masters, 5th ed. London: International Chamber of Shipping; OCIMF, 1998. ISBN 0-984691-46-8.

T14 Accident Prevention on Board Ship at Sea and in Port, 2nd ed. Geneva: International Labour Office, 1996. ISBN 92-2-109450-2.

T15 Kemp, J.F.; Young, P. Notes on Compass Work, 2nd ed. London: Stanford Maritime, 1972. ISBN 0-540-00362-x.

T16 Lownsborough, R.; Calcutt, D. Electronic Aids to Navigation: Radar and ARPA. 1st ed. London: Edward Arnold, 1993. ISBN 0-340-59258-3.

T17 MacElvrey, D.H. Shiphandling for The Mariner, 3rd ed. Centreville, Maryland: Cornell Maritime Press, 1995. ISBN 0-87033-464-6.

T18 Cornish, M. Reeds Maritime Meteorology. 3rd Ed. Updated. : Sunderland: Thomas Reed Publications: 2009. ISBN 978-1-4081-1206-9.

T19 Marine Observer's Handbook, 11th ed. London, HMSO: 1995. ISBN 0-11-400297-5.

T20 Meteorology for Mariners (Met.0.895), 3rd Ed. Revised. London: HMSO, 1996. ISBN 0-114-00367X.

T21 The Shiphandler's Guide. London: The Nautical Institute, 2000. ISBN 978-1-870077-35- 4.

T22 Swift, A.J. Bridge Team Management: A Practical Guide, 2nd Ed. London: The Nautical Institute, 2004. ISBN 1-870077-66-0

T23 Tetley, L.; Calcutt, D. Electronic Aids to Navigation. London: Edward Arnold, 1986. ISBN 0-7131-3548-4.

T24 Wright, C.H. Collision Regulations: Fully Explained. 2nd ed. Glasgow: Brown, Son & Ferguson, 1989. ISBN 0-904-825-08-6.

T25 Squat and Interaction Manoeuvring, London: The Nautical Institute, 1995. ISBN 978-1-870077-25-5

T26 Derret, D.R.; Barrass, B. Ship Stability for Masters and Mates, 7th ed. Oxford: Butterworth-Heinemann, 2008. ISBN 978-0080970936

T27 ISGOTT: International Safety Guide for Oil Tankers & Terminals, 5th ed.
Revised. London: Witherby & Co. Ltd, 2006. ISBN 978-1856092913

T28 Lavery, H.I. Shipboard Operations, 2nd ed. London: Heinemann, 1990. ISBN 0-4434-91094-0

T29 Morton, G.S. Tanker Operations: A Handbook for the Ship's Officer, 3rd ed. Cambridge: Cornell Maritime Press, 1992. ISBN 0-87033-432-8.

T30 Taylor L.G. Cargowork, 12th ed. Glasgow: Brown, Son & Ferguson Ltd. 1992. ISBN 0-85174-605-5.

T31 Pepper, G.M. Thoma's Stowage: The Properties and Stowage of Cargoes, 5th ed. Glasgow: Brown, Son & Ferguson, 2008. ISBN 9780851747989

T32 Code of Safe Working Practices for Merchant Seamen, Consolidated Edition. London: The Stationery Office Publications Centre, 2010. ISBN 978-0-11-553170-5

T33 Taylor, D.A. Merchant Ship Construction, 4th ed. London: Institute of Marine Engineers, 1998. ISBN 978-1902536002

T34 Roberts, P. Watchkeeping safety and cargo management in port. London: The Nautical Institute, 1995. ISBN 1-870077-29-6

Part B: Course Outline and Timetable

Overview

The following section presents the topics of the 43-hour course in a simplified outline format. The 20 topics are organized into 7 general Subject Areas or exercises:

1. Familiarization with simulators
2. Planning a voyage
3. Watchkeeping
4. Manoeuvering
5. Cargo handling for different kinds of ships
6. Emergencies and rescue
7. Controlling the operations of the ship and care on board

A familiarization with the simulation tools is also necessary for the trainee. For evaluating the trainee, these exercises should be shorter, and he/she should select one from each group.
Planning voyage and watchkeeping exercises are single but long exercises; **manoeuvering exercises** depend on whether the ship berths, unberths, anchors, etc., and the **cargo handling exercises** also depend on the kind of cargo/type of ship. **Emergencies and rescue group** consist of some skills/knowledge areas that need one or more exercises for each area. It is also important to note that the supporting materials should be exposed, and the trainee should be evaluated, before each simulator session.

Another important point involves elaborating all supporting materials (SM), and finally, determining the time required for explaining and evaluating all skills/knowledge points.

The following table shows the evaluable competences in each group.

Exercise	Competences for the Management level
1. Familiarization	
2. Planning a voyage	**Competence 12.** Plan a voyage and conduct navigation **Competence 18.** Maintain the safety of navigation through the use of ECDIS and associated navigations system to assist in command decisions making
3. Watchkeeping	**Competence 13.** Determine position and the accuracy of resultant position fix by any means**.** **Competence 14.** Determine and allow for compass errors. **Competence 16.** Establish watchkeeping arrangements and procedure**.** **Competence 17.** Maintain safe navigation through the use of information from navigation equipment and systems to assist in command decision making.

4. Manoeuvering	**Competence 19.** Manoeuver and handle a ship in all conditions. **Competence 20.** Operate remote controls of propulsion plant and engineering systems and services
5. Cargo handling	**Competence 21.** Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes. **Competence 22.** Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action. **Competence 23** Carriage of dangerous goods.
6. Emergencies and rescue	**Competence 15.** Coordinate search and rescue operations.
7. Controlling the operations	**Competence 24.** Control trim, stability and stress. **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. **Competence 26.** Use of leadership and managerial skill.

Table 1. Main Structure of the course considering competences to be evaluated

The total number of hours is allocated in the following manner:

Familiarization with simulators	Briefings, debriefings and no-simulation explanations	Simulation trainings	Evaluation in simulators	Evaluation with theoretical exam
2.0 hrs	**19.5hrs**	**18.5hrs**	**2.0 hrs**	**1.0 hrs**

The duration allocated to each topic is presented in the Course Timetable, and is repeated in Part C – Detailed Teaching Syllabus, and in Part D – Lesson Plans and Exercises. The Learning Objectives for each topic are presented generally in Part C, and with full detail in Part D.

As defined in Part A – Course Framework, the Classroom setting should provide one workstation for each trainee, and all workstations should be networked with the simulation instructor and server.

Course Outline

Familiarization with simulators	Hours
01. Knowledge of the fundamentals and limitations of the simulators used in the course (0.5 h) 02. Ability to operate and to interpret and analyse information obtained from simulators (1.5 h)	2.0

Planning a voyage	Hours
03. Plan a voyage and conduct navigation (2.0 h) 04. Maintain the safety of navigation through the use of ECDIS and associated navigations system to assist in command decisions making (1.5 h)	3.5

Watchkeeping	Hours
Determine position and the accuracy of resultant position fix by any means. Position determination in all conditions: 05. By celestial observations (2.0 h) 06 By terrestrial observations, including the ability to use appropriate charts, notices to mariners and other publications to assess the accuracy of the resulting position fix (1.0 h) 07. Using modern electronic navigation aids, with specific knowledge of their operating principles, limitations, sources of error, detection of misrepresentation of information and methods of correction to obtain accurate position fix (1.5 h) 08. Determine and allow for compass errors. (2.0 h) Establish watchkeeping arrangements and procedures: 09. Thorough knowledge of content, application and intent of the International Regulations for Preventing Collisions at Sea, 1972, as amended (2.0 h) 10. Thorough knowledge of the content, application and intent of the Principles to be observed in keeping a navigational watch (2.0 h) 11. Maintain safe navigation through the use of information from navigation equipment and systems to assist in command decision making (2.5 h)	13.0

Manoeuvering	Hours
12. Manoeuver and handle a ship in all conditions (4.0 h) 13. Operate remote controls of propulsion plant and engineering systems and services (2.0 h)	6.0

Cargo handling	Hours
14. Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes (5.5 h) 15. Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action (1.0 h) 16. Carriage of dangerous goods (1.5 h)	8.0

Emergencies and rescue	Hours
17. Coordinate search and rescue operations (2.0 h)	2.0

Controlling the operations	Hours
18. Control trim, stability and stress (2.0 h) 19. Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and the protection of the marine environment (2.0 h) 20. Use of leadership and managerial skill (1.5 h)	5.5

Course Timetable

Generally, each simulation training has a duration of 2 hours; being the first half hour a briefing, the last half hour a debriefing, with one hour of simulation in between.

The following timetable has been thought for doing 2 sessions in the mornings and 1 session in the afternoons during 7 days. Between both morning sessions a break of half an hour is recommended. For example, if the first session starts at 09.00 and finishes at 11.00; the second one starts at 11.30 and finishes at 13.30, and the third one starts at 16.00 and finishes at 18.00, except for the last day (evaluation) that it finishes at 19.00. Otherwise, a more intensive course may be done with 2 sessions in the morning and two other sessions in the afternoons during 5 days, adding a sixth morning for evaluating the trainees. In both cases, the course consists of 20 sessions of 2 hours and one exam of 3 hours.

In the timetable, S and NS indicate whether the knowledge/skill can be acquired by a simulation or not.

Day/ Period	1st Period (2.0 hours)	2nd Period (2.0 hours)	3rd Period (2.0 hours)
Day 1	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. Plan a voyage and conduct navigation (0.5 h) **NS** (briefing) (1.0 h) **S** (0.5 h) **NS** (debriefing)	04. Maintain the safety of navigation through the use of ECDIS and associated navigations system to assist in command decisions making (1.0 h): Management of operational procedures, system files and data (0.5 h) **NS** (briefing) (0.5 h) **S** 06. Determine position by terrestrial observations (1.0) (0.5 h) **NS** (briefing) (0.5 h) **S**
Day 2	05. Determine position by celestial observations (2.0 h) **NS**	07. Determine position using modern electronic navigation aids (0.5 h) **NS** (briefing) (0.5 h) **S*** (0.5 h) **NS** (debriefing) 04. Maintain the safety of navigation through the use of ECDIS and associated navigations system to assist in command decisions making (0.5 h): Use ECDIS playback functionality for passage review, route planning and review of system functions (0.5 h) **S*** *Both competences assessed in the same simulation training	08. Determine and allow for compass error (0.5 h) **NS** (briefing) (1.0 h) **S** (0.5 h) **NS** (debriefing)
Day 3	09. Thorough knowledge of content, application in and intend of the International Regulations for Preventing Collisions at Sea (2.0 h) **NS**	10. Thorough knowledge of the content, applications and intend of the Principles to be observed in keeping a navigational watch (0.5 h) **NS** (briefing) (1.0 h) **S** (0.5 h) **NS** (debriefing)	11. Maintain safe navigation through the use of information from navigational equipment and systems to assist in command decision making: Appreciation of system errors and thorough understanding of the operational aspects of navigation systems; Blind pilotage planning; Evaluation of navigational information derived from all sources (0.5 h) **NS** (briefing) (1.0 h) **S** (0.5 h) **NS** (debriefing)

Day 4	12. Manoeuver and handling a ship in all conditions (See Part C. Manoeuver: points 1 to 10) (2.0 h) **S**	12. Manoeuver and handling a ship in all conditions (See Part C. Manoeuver: points 11 to 18) (0.5 h) **NS** (briefing) (1.0 h) **S** (0.5 h) **NS** (debriefing)	13. Operate remote controls of propulsion plant and engineering systems and services (0.5 h) **NS** (briefing) (1.0 h) **S** (0.5 h) **NS** (debriefing)
Day 5	14. Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes: General (0.5 h) **NS** (briefing) (1.0 h) **S** (0.5 h) **NS** (debriefing)	14. Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes: Tankers and bulk-carriers (0.5 h) **NS** (briefing) (1.0 h) **S** (0.5 h) **NS** (debriefing)	14. Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes: Effective communications and improving working relationship between ship and terminal (1 h), combined with 15. Assess reported defects and damages to cargo spaces, hatch covers and ballast tanks and take appropriate action (1 h) (0.5 h) **NS** (briefing) (1.0 h) **S** (0.5 h) **NS** (debriefing)
Day 6	16. Carriage of dangerous goods (1.5 h), combined with 14. Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes: Procedures for safe cargo handling in accordance with the provisions of the relevant instruments such as IMDG Code, IMSBC and annexes III and V of MARPOL (0.5 h) (0.5 h) **NS** (briefing) (1.0 h) S (0.5 h) **NS** (debriefing)	17. Coordinate search and rescue operations (0.5 h) **NS** (briefing) (1.0 h) **S** (0.5 h) **NS** (debriefing)	18. Control trim, stability and stress (0.5 h) **NS** (briefing) (1.0 h) **S** (0.5 h) **NS** (debriefing)

Day 7	19. Monitor and control compliance with legislative requirements and measures to ensure safety life of life at sea, security and the protection of the marine environment (1.5 h) **NS** (0.5 h) **S**	20. Use of the leathership and managerial skill (1.0 h) **S** (0.5 h) **NS** (debriefing) 11. Maintain safe navigation thorough the use of information from navigation system and systems to assist in command decision making: The interrelationship and optimum use of all navigational data available for conducting navigation (0.5 h) **S**	38. Evaluation with theoretical exa(1.0 h) **NS** 39. Evaluation in simulators (2.0(0.5h) **S**

Note: Teaching staff should note timetables are suggestions only as regards the sequence and length of time allocated to each objective. These factors may be adapted by instructors to suit individual groups of trainees depending on their experience and ability and on the equipment and staff available for the training.

- The first session corresponds to Subject Area 1: Familiarization with the different kinds of simulators (2 hours of simulation).
- The second session and the first part of the third one correspond to Subject Area 2: Planning a voyage (1.5 hours of simulation and 1.5 hours with only other teaching aids).
- The second part of session Nr. 3 to Nr. 9 (included) and the last part of number 20 correspond to Subject Area 3: Watchkeeping (5 hours of simulation and 8.5 hours with other only teaching aids);
- Sessions Nr. 10 to Nr. 12 (both included) correspond to Subject Area 4: Manoeuvering (4 hours of simulation and 2 of briefings and debriefings).
- Sessions Nr. 13 to Nr.16 correspond to Subject Area 5: Cargo handling (4 hours of simulation and 4 hours of briefings and debriefings).
- Session Nr. 17 corresponds to Subject Area 6: Emergencies and rescue (1 hour of simulation and 1 hour of briefing/debriefing).
- Session Nr. 18 to the first part of number 20 correspond to Subject Area 7: Controlling the operations (2.5 hours of simulation and 3 hours of briefings/debriefings and other teaching aids).

Part C: Detailed Teaching Syllabus

The detailed teaching syllabus has been written in learning objective format in which the objective describes what the trainee should do to demonstrate that knowledge has been transferred. All objectives are understood to be prefixed by the words, “The expected learning outcome is that the trainee…”

In order to assist the instructor, reference publications are shown against the learning objectives in addition technical material and teaching aids, which the instructor may wish to use when preparing course material. 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);
and Textbooks (indicated by T)

In IMO courses, Electronic Media are indicated by E, but in this case, IAMU has considered, according to the objective of this course, that makes no sense to distinguish between electronic media and other teaching aids. Therefore, simulators, like audiovisual aids and recordings, are referred to as a teaching aid, indicated by A.

The following table gives, in a wider form, the knowledge/skills of each topic, and the teaching aids and references that are used. The teaching aids are referred for each specific knowledge/skill, while the references are given for a whole subject area, except for watchkeeping, due to its extension.

Note

Throughout the course, safe working practices are to be clearly defined and emphasized with reference to current international requirements and regulations. It is expected that the institution implementing the course will insert references to national and/or regional requirements and regulations as necessary.

Learning Objectives

Subject areas and topics have been outlined in Part B. In Part C, the Learning Objectives associated with each topic are provided, along with teaching aids and references. In Part D, the topics are referred to as Lesson Plans, and the Learning Objectives are further described in sufficient detail for the development of a revalidation of the correspondent National Certificate of Officer in Charge of a Navigational Watch. The Learning Objectives are presented in a verb-based manner to facilitate outcomes-driven learning and skills development. All Learning Objectives are understood to be prefixed by the phrase: “The expected learning outcome is that the trainee is able to . . . .”

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
1.Familiarization with simulators (2 hours)		
1.1 Knowledge of the fundamentals and limitations of the simulators used in the course (0.5 h) – Topic 01	A1 A2	B6 B7 R51
1.2. Ability to operate, to interpret and analyse information obtained from simulators (1.5 h) – Topic 02	A1	
- Navigation equipment trainer (NAV)		
- Communication procedures/GMDSS equipment trainer (COM)		
- Radar simulator (RAD)		
- Radar and navigation simulator (NAV/RAD)		
- Ship handling simulator with/without motion platform/image generation (SHIP)		
- Crane handling simulator (CRA)		
- Vessel traffic management simulator (VTS)		
- Search and rescue management trainer (SAR)		
- Oil spill management trainer (SPILL)		
- Cargo handling trainer (CAR)		
- Ballast control trainer (BAL)		

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
2. Planning a voyage (3,5 hours)		
2.1. Plan a voyage and conduct navigation (2.0 h) – Topic 03	A1 A3	R1 R2 R4 R6 R7 R8 R9 R10 R51 T5 T6 T7 T9 T10
2.1.1. Voyage planning and navigation for all conditions by acceptable methods of plotting ocean tracks (0.75 h), taking into account:		
Restricted waters		
Meteorological conditions		
Ice		
Restricted visibility		
Traffic separation schemes		
Vessel traffic services (VTS) areas		
Areas of extensive tidal effects		
2.1.2. Routeing in accordance with the General Provisions on Ship's Routeing (0.75 h)		
2.1.3. Reporting in accordance with the General principles for Ship Reporting Systems and VTS procedures (0.5 h)		
2.2. Maintain the safety of navigation through the use of ECDIS and associated navigation systems to assist in command decision-making (1.5 h) – Topic 4	A1 A2	
2.2.1. Management of operational procedures, system files and data (1.0 h), including:		
1. manage procurement, licensing and updating of chart data and system software to conform the established procedure		
2. system and information updating, including the ability to update ECDIS system version in accordance with vendor's product development		
3. create and maintain system configuration and backup files		
4. create and maintain log files in accordance with established procedures		
5. create and maintain route plan files in accordance with established procedures		
6. use ECDIS log-book and track history functions for inspection of system functions, alarm settings and user responses		
2.2.2. Use ECDIS playback functionality for passage review, route planning and review of system functions (0.5 h)		

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
3. Watchkeeping (13.0 hours)		
3.1. Determine position and the accuracy of resultant position fix by any means. Position determination in all conditions:		R1 R2 R3 R4 R5 R8 R9 R10 R11 R12 R13A/B R14A/B/C R15A/B R16A/B R18 R22 R23 R24 R25 R26A/B/C R27 R28 R29 R51 T1 T2 T3 T4 T5 T6 T7 T9 T10 T12 T15 T16 T18 T19 T20 T22 T23 T24 T34
3.1.1. By celestial observations (2.0 h) – Topic 5. Practise in the use of the sextant; sextant corrections; position at noon; position at crepuscles using the Sight Reduction Tables for Navigation; provide programmes that make calculations	(A1) A2 A3 A4 A6	
3.1.2. By terrestrial observations, including the ability to use appropriate charts, notices to mariners and other publications to assess the accuracy of the resulting position fix (1.0 h) – Topic 6	A1 A2 A3 A4	
3.1.3. Using modern electronic navigation aids, with specific knowledge of their operating principles, limitations, sources of error, detection of misrepresentation of information and methods of correction to obtain accurate position fix (1.5 h) – Topic 7	A1 A2 A3	
3.2. Determine and allow for compass errors. (1.5 h) – Topic 8	A1 A2 A3 A4	
3.2.1. Ability to determine and allow for errors of the magnetic compasses and gyro-compasses (0.5 h)		
3.2.2. Knowledge of the principles of magnetic and gyro-compasses (0.5 h)		
3.2.3. Understanding of systems under the control of the master gyro and a knowledge of the operation and care of the main types of gyro-compass (0.5 h)		
3.3. Establish watchkeeping arrangements and procedures		
3.3.1. Thorough knowledge of content, application and intent of the International Regulations for Preventing Collisions at Sea, 1972, as amended (2.0 h) – Topic 9	A1 A2 A3 A4	
3.3.2. Thorough knowledge of the content, application and intent of the Principles to be observed in keeping a navigational watch (2.0 h) – Topic 10	A1 A2 A3 A4	
3.4. Maintain safe navigation through the use of information from navigation equipment and systems to assist in command decision making (2.5 h) – Topic 11	A1 A2 A3 A4	
3.4.1. Appreciation of system errors and thorough understanding of the operational aspects of navigational systems (0.5 h)		
3.4.2. Blind pilotage planning (1.0 h)		
3.4.3. Evaluation of navigational information derived from all sources, including radar and ARPA, in order to make and implement command decisions for collision avoidance and for directing the safe navigation of the ship (0.5 h)		
3.4.4. The interrelationship and optimum use of all navigational data available for conducting navigation (0.5 h)		

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
4. Manoeuvering (6.0 h)		
4.1. Manoeuver and handle a ship in all conditions (4.0 h) – Topic 12. Manoeuvering and handling a ship in all conditions, including:	A1 A2 A3 A4	R1 R2 R4 R5 R20 R21A/B R51 R52 T17 T21 T22 T25
1. manoeuvers when approaching pilot stations and embarking or disembarking pilots, with due regard to weather, tide, headreach and stopping distances		
2. handling a ship in rivers, estuaries and restricted waters, considering the effects of current, wind and restricted water on helm response		
3. application of constant-rate-of-turn techniques		
4. manoevering in shallow water, including the reduction in underkeel clearance caused by squat, rolling and pitching		
5. interaction between passing ships and between own ship and nearby banks (canal effect)		
6. berthing and unbearthing under various conditions of wind, tide and current with and without tugs		
7. ship and tug interaction		
8. use of the propulsion and manouvering systems		
9. use of anchorage; anchoring with one or two anchors in limited anchorages and factors involved in determining the length of anchor cable to be used		
10. dragging anchor; cleaning fouled anchors		
11. dry-docking, both with and without damage		
12. management and handling of ships in heavy weather, including assisting a ship or aircraft in distress; towing operations; means of keeping an unmanageable ship at sea, lessening drift and use of oil		
13. precautions in manoeuvering when launching rescue boats or survival crafts in bad weather. Manoeuver is evaluable on the bridge (course and speed appropriate), but not on deck (launching boats). Notwithstanding, the launching procedures can be explained during the briefing or debriefing.		
14. methods of taking survivors on board from rescue boats and survival craft. Manoeuver is evaluable in the bridge (course and speed appropriate), but not on deck (boat recovery). Notwithstanding, the boat recovery procedures can be explained during the briefing or debriefing.		
15. ability to determine the manovering and propulsion characteristics of common types of ships, with special reference to stopping distances and turning circles at various draughts and speeds NAV and/or SHIP		

16. importance of navigating at reduced speed to avoid damage caused by own ship's bow wave and stern wave		
17. practical measures to be taken when navigating in or near ice or in conditions of ice accumulation on board		
18. use of, and manoeuvering in and near, traffic separation schemes and in vessel traffic service (VTS) areas		
4.2. Operate remote controls of propulsion plant and engineering systems and services (2.0 h) – Topic 13	A1 A4	
(a) Operating principles of marine power plants (0.5 h)		
(b) Ships' auxiliary machinery (1.0 h) SHIP, CAR, BAL, and SM during the briefing		
(c) General knowledge of marine engineering terms (0.5 h)		

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
5. Cargo handling (8.0 h)		
5.1. Plan and ensure safe loading, stowage, securing, care during the voyage and unloading of cargoes (5.5 h) – Topic 14	A1 A2 A4	R1 R2 R4 R5 R30 R31A/B R32 R33 R34 R35 R36 R37 R38 R39 R40 R41 R42 R51 T26 T27 T28 T29 T30 T31 T32
5.1.1. knowledge of and ability to apply relevant international regulations, codes and standards concerning the safe handling, stowage, securing and transport of cargoes (0.5 h)		
5.1.2.a. Knowledge of the effect of cargoes and cargo operations on trim and stability (0.5 h)		
5.1.2.b. Use of stability and trim diagrams and stress-calculating equipment, including automatic data-based (ADB) equipment, and knowledge of loading cargoes and ballasting in order to keep hull stress within acceptable limits (0.5 h)		
5.1.3.a. Stowage and securing of cargoes on board ships, including cargo-handling gear and securing and lashing equipment (0.5 h)		
5.1.3.b. Loading and unloading operations, with special regard to the transport of cargoes identified in the Code of Safe Practices for Cargo Stowage and Securing (0.5 h)		
5.1.4. General knowledge of tankers and tanker operations (1.0 h)		
5.1.5. Knowledge of the operational and design limitations of bulk carriers (1.0 h)		
5.1.6. Ability to establish procedures for safe cargo handling in accordance with the provisions of the relevant instruments such as IMDG Code, IMSBC Code, MARPOL 73/78 Annexes III and V and other relevant information (0.5 h)		
5.1.7. Ability to explain the basic principles for establishing effective communications and improving working relationship between ship and terminal personnel (0.5 h)		
5.2. Assess reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action (1.0 h) – Topic 15	A1 A2 A4	

5.2.a. Knowledge of the limitations on strength of the vital construction parts of a standard bulk carrier and ability to interpret given figures for bending moments and shear forces (0.5 h)		
5.2.b. Ability to explain how to avoid the detrimental effects of corrosion, fatigue and inadequate cargo handling on bulk carriers (0.5 h)		
5.3. Carriage of dangerous goods (1.5 h) – Topic 16		
5.3.1. International regulations, standards, codes and recommendations on the carriage of dangerous cargoes, including the International Maritime Dangerous Goods (IMDG) Code and the International Maritime Solid Bulk Cargoes (IMSBC) Code (0.5 h).	A1 A2 A4	
5.3.2. Carriage of dangerous goods, hazardous and harmful; precautions during loading and unloading and care during the voyage (1.0 h) *(An example of simulation training could be loading a container ship with some containers with dangerous goods)*		

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
6. Emergency and rescue (2.0 h)		
6.1. Coordinate search and rescue operations (2.0 h) – Topic 17. Thorough knowledge of and ability to apply the procedures described in the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual	A1 A2 A4	R1 R2 R4 R5 R16A/B R17 R18 R19 R22 R43A/B R44 R45 R46 R47 R48 R49 R50 R51 R52 T13 T14

Knowledge, Understanding and Proficiency	Teaching Aid	Reference
7. Controlling the operations (5.5 h)		
7.1. Control trim, stability and stress (2.0 h) – Topic 18	A1 A2 A4	R1 R2 R4 R5 R30 R42 R43A/B R44 R45 R46 R47 R48 R49 R50 R51 R52 T26 T27 T28 T33 T34
7.1.1. Understanding of fundamental principles of ship construction and the theories and factors affecting trim and stability and measures necessary to preserve trim and stability (0.75 h)		
7.1.2. Knowledge of the effect on trim and stability of a ship in the event of damage to and consequent flooding of a compartment and countermeasures to be taken (0.75 h)		
7.1.3. Knowledge of IMO recommendations concerning ship stability (0.5 h)		
7.2. Monitor and control compliance with legislative requirements and measures to ensure safety of life at sea, security and the protection of the marine environment (2.0 h) – Topic 19. Knowledge of international maritime law embodied in international agreements and conventions. Special attention shall be paid especially to the following subjects:	A1 A2 A4	
1. certificates and other documents required to be carried on board ships by international conventions, how they may be obtained and their period of validity		
2. responsibilities under the relevant requirements of the International Convention on Load Lines, 1966, as amended		
3. responsibilities under the relevant requirements of the International Convention for the Safety of Life at Sea, 1974, as amended		
4. responsibilities under the International Convention for the Prevention of Pollution from Ships, as emended		
5. maritime declarations of health and the requirements of the International Health Regulations		
6. responsibilities under international instruments affecting the safety of the ship, passengers, crew and cargo		
7. methods and aids to prevent pollution of the marine environment by ships		
8. national legislation for implementing International agreements and conventions		
This competence consists of a wide knowledge of legislative requirements. Notwithstanding some skills may be simulated, as for example, loading until appropriate draft, according to the International Convention on Load Lines, or discharging oily waters using a virtual flow-meter according MARPOL.		

7.3. Use of leadership and managerial skill (1.5 h) – Topic 20		
7.3.1. Knowledge of shipboard personnel management and training	A1 A2 A4 A5	
7.3.2. Knowledge of related international maritime conventions and recommendations, and national legislation		
7.3.3. Ability to apply tasks and workload management, including:		
1. planning and co-ordination		
2. personnel assignment		
3. time and resource constraints		
4. prioritization		
7.3.4. Knowledge and ability to apply effective resource management:		
1. allocation, assignment, and prioritization of resources		
2. effective Communications on board and ashore		
3. decisions reflecting consideration of team experiences		
4. assertiveness and leadership, including motivation		
5. obtaining and maintaining situation awareness		
7.3.5. Knowledge and ability to apply decision-making techniques:		
1. situation and risk assessment		
2. identifying and generating options		
3. selecting course of action		
4. evaluation of outcome effectiveness		
7.3.6. Development, implementation, and overview of standard operating procedures		
1. decisions reflecting consideration of team experiences		
2. assertiveness and leadership, including motivation		
3. obtaining and maintaining situation awareness		

Part D: Instructor Manual

For this CoC revalidation course, the instructor manual section defines the exercise scenario for each of the exercises, taking into account that each exercise has different parts, contents and objectives, which are:

LEVEL/EXERCISE NUMBER. For this CoC revalidation course, the levels are only Operational or Management. Then, an exercise indicates:

The level: Operational (OP) or Management (MAN).

The subject area: Familiarization (FAM), Planning a voyage (VOY), Watchkeeping (WAT), Manoeuvering (MAN), Cargo Handling (CAR), Emergencies and rescue (E&R) and Controlling the operations (CON).

The number of the subject area exercises.

TITLE. The title gives a brief description of the exercise. This description includes: the subject area, the scenario and the type of ship. The scenario depends on the subject area. It includes, although it is not limited to: geographic area, cargo to be loaded/discharged or emergency (fire, collision, grounding, etc.).

REFERENCES. References are publications and books where the instructor and the trainee can find the theoretical knowledge they shall apply during the simulation.

OBJECTIVES. A clear conception of the objectives of the exercise is required by the instructor and the trainee. Each exercise has some generic objectives. Moreover, during the training session, more specific objectives must be indicated by the instructor, and these objectives are expected to be accomplished by the trainees. Thus, each exercise has:

- Required instructor actions
- Expected student actions

With the required instructor actions, the instructor creates some simulated conditions by means of which the trainee learns the proper actions to be taken. On the other hand, the expected student actions learn or evaluate the response of the trainee by observing if he/she is taking the expected actions with the conditions simulated by the instructor. In addition, the list of expected student actions can be used as the exam guide, as it should correspond with the aspects inquired in the exam. Therefore, in each exercise, the required instructor actions and the expected students' actions must be indicated.

PREREQUISITES. Before the training session, the students must be familiarized with some knowledge and skills. If they are not familiar with these skills/knowledge, probably they will not be able to take the proper action during the training session or will not understand the objectives of the exercise. Note that these prerequisites depend on the generic objectives of the exercise.

BRIEFING. Once the objectives are determined and the prerequisites guaranteed, trainees need some knowledge about more specific prerequisites for a proper comprehension of the conditions and the actions to be taken during the simulation session. For this reason, those skills/knowledge must be explained before the simulation session.

TRAINING MATERIALS. Training materials are the teaching aids as defined in the part C of the model course. Some of them are necessary for each exercise.

INITIAL CONDITION OF THE SIMULATOR. It also depends on the kind of exercise, and therefore, on the kind of simulator required for the exercise. The initial simulator condition depends on the parameters the simulator has; however, in any case, the initial conditions must be specified.

STUDENT AND INSTRUCTOR ACTIONS. Both actions must be clearly defined, specially the instructor ones, because the exercise depends on his/her action. On the other hand, each exercise requires some student actions which determine whether he/she is has the evaluated skills. For a clear assessment, these student actions must be specified.

DURATION AND TIMETABLE. The duration and the contents of the briefing and debriefing must be specified. Moreover, the development of the exercise must also be quantified.

SIMULATOR RUN. In the simulation, the skills and times must be accurately determined as well as the required instructor actions and expected student actions so that the exercise can be properly evaluated.

DEBRIEFING/EVALUATION. After the simulation, a discussion of the exercise is required, especially of those aspects students had problems with or of the incorrect or inappropriate actions. This is very important for the trainee, because he/she does not only learn from the teacher explanations and the above mentioned references, but also from his/her own mistakes. Consequently, the analysis of his/her improper action becomes knowledge that he/she is going to remember in a real situation, which increases the safety of navigation, cargo operations, etc.
Furthermore, the evaluation consists in: checking whether students are capable (all objectives met) of using the bridge equipment properly in future exercises.

EXAMPLE:
In the following pages, we attach an example considering the above sections:

LEVEL/EXERCISE NUMBER: *MAN/FAM/1; i.e.: exercise number 1 for the subject areas of Familiarization and Management level.*

TITLE: *Bridge familiarization. Dover Strait. TSS off Boulogne. Bulkcarrier. This title indicates that: this exercise is about bridge familiarization; it consists of two simulations in different simulated areas (the Dover Strait and the TSS off Boulogne), and in both cases, the simulated ship is a bulkcarrier.*

REFERENCES:

- *Bridge* watchkeeping *(Nautical Institute ISBN 1870077172)*
- *Bridge Team Management (Nautical Institute ISBN 1870077660)*
- *Mariner's Handbook*

OBJECTIVES:
Generic objectives: Familiarize the student with:

- *Introduction in the use of simulators*

- *Familiarization with the simulator and equipment*

Specific objectives: The specific objectives are indicated in the attached table. Also, for each specific objective, the required instructor actions and the expected student actions must be indicated, as shown in the same table.

PREREQUISITES:

- *Basic theoretical navigational knowledge*
- *Knowledge of COLREGS*

BRIEFING:

- *Getting acquainted with students.*
- *Introducing bridge exercises during this course.*
- *Explaining a bridge exercise (briefing, training, debriefing).*
- *Pointing out and explaining instrumentation and bridge indicators.*
- *Chart handling and using of charts.*
- *Assessing risk of collision by pelorus.*
- *Explaining different time notations.*

TRAINING MATERIALS:

- *Full bridge simulator (including all the navigational equipment)*
- *Overhead sheets and/or power point presentation*
- *Pelorus*
- *Pilot card (ship's particulars and maneuvering tests)*
- *Chart to be used: BA 1892*

In other cases, these training materials may consist of some aids for a theoretical explanation, for example, a power point presentation.

INITIAL CONDITION OF THE SIMULATOR:

For the first simulation of the exercise, the initial conditions are:

- *Type of ship: Bulkcarrier (90.0 x 14 x 5.7)*
- *Initial position: 50º44.5'N 001º23.8'W*
- *Initial time: 1000 UTC*
- *Initial course: 015 (ground)*
- *Initial speed: 12.0 knots*
- *Engine status: Full Ahead*
- *Correction gyro course: + 1.5º*
- *Tidal stream: 015º 1.0 knots*
- *Wind dir. And speed: W 5 Beaufort*
- *Visibility: > 10 miles*
- *Targets (initial position, course and speed):*
- *Ownship 50º44.5N 001º23.8'E 015º 12'; Toledo Bay ...46.4...26.9 013º 19'; NII Colombo ...47.5...23.6 021º 11.5'; Koper Express ...48.0...26.2 015º 9'; Roxanne (fishing vessel) ...52.0...19.8 109º 11'; Esso Atlantic ...59.5...24.3 217º 9'; Smit Lloyd 115 (tug) ...52.4...25.8*

015º 3'; Ever Trade ...41.5...24.7 011º 16'; Tow 1 ...52.0...25.6 015º 3'; Quiberon ...44.6...34.0 283º 15'; Barraganul ...45.0...31.0 282º 12'; Horsa 51º03.6'N...23.1 148º 18'

Note that if the instructor does not take care in keeping the specified initial conditions, the exercise will not simulate the required condition. For example, let's take two vessels involved in a risk of collision with a determinate wind and sea state. If this condition is not introduced or it is altered, the speeds of both ships will be different, and they may not be involved in the required risk of collision situation.

STUDENT AND INSTRUCTOR ACTIONS:

Student action:

- *During briefing: attending the lecture and explaining the use of simulators and voyage planning.*
- *During exercise: explaining a bridge inventory, familiarizing and trying out a full mission bridge simulator, according to the points of the added schedule in the simulation below.*

Instructor action:

- *Before starting the simulation, explaining simulator inventory.*
- *Before handing over the watch poining out the traffic.*
- *Monitoring and observing students and ascertaining whether objectives are met.*
- *Monitoring and observing if a natural task division develops.*
- *Monitoring conversations in relation to the later explained SMCP.*
- *Staying on bridge when requested by students.*
- *Observing and noting social order in group.*

DURATION AND TIMETABLE:

- *Briefing: 30 minutes, with the contents above detailed.*
- *Simulator run: 60 minutes, with two simulations: Dover Strait and TSS off Boulogne*
- *Debriefing: 30 minutes, with the contents below explained.*

SIMULATOR RUN. *The schedule of the two simulations is provided as an example and guide of all aspects that must be taken into account during the simulation. Note that, as previously indicated, the skills and times are very well determined, and also the required instructor actions and expected students actions.*

DEBRIEFING/EVALUATION. *After the simulation, a discussion of the exercise is required, especially of those aspects students had problems with or of improper actions. For this exercise, the points of the debriefing are:*

- *Reiterating objectives and checking if they are met.*
- *Pointing out positive actions.*
- *Starting a discussion by means of peer view.*
- *Playing back the exercise and discussing ship's movements.*
- *Summarizing students' actions and conclusions.*
- *Discussing points for improvement.*

Part E: Evaluation and assessment

Introduction

The effectiveness of any evaluation depends on the accuracy of the description of what is to be measured. The learning objectives that are used in the detailed teaching syllabus, Column 3 – Methods for demonstrating competence, and Column 4 – Criteria for evaluating competence, in A-II/2 of the STCW Code, establish the methods and criteria for evaluation. From these methods, there is a selection of those which can be assessed by simulator. According to the competences of the Code and to the structure of this course, there are six Subject Areas to be evaluated in a three-hour period.

Objective

The learning objectives that are used in the detailed teaching syllabus will provide a sound basis for the construction of suitable simulations/tests for evaluating trainee progress.

Those who successfully complete this course should be able to demonstrate sufficient knowledge, skill and understanding of the competences (that can be evaluated by simulator) described in the table A-II/2 of the STCW Code, as amended. This knowledge, skill and understanding should be included in column 1 of table A-II/2:

Navigation:

- Planning a voyage and conducting navigation
- Determining position and the accuracy of resultant position fix by any means
- Determining and allowing for compass errors
- Coordinating search and rescue operations
- Establishing watch keeping arrangements and procedures
- Maintaining a safe navigation through the use of navigation equipment and systems to assist command decision-making
- Maintaining the safety of navigation through the use of ECDIS and an associated navigation system to assist in command and decision-making
- Maneuvering and handling a ship in all conditions
- Operating remote controls of propulsion plants and engineering systems and services (20)

Cargo handling and stowage:

- Planning and ensuring a safe loading, stowage, securing, care during the voyage and unloading of cargoes
- Assessing reported defects and damage to cargo spaces, hatch covers and ballast tanks and take appropriate action
- Carriage of dangerous cargoes

Controlling the operation of the ship care for persons on board:

- Controlling trim, stability and stress
- Monitoring and controlling in compliance with legislative requirements and measures to ensure the safety of life at sea and the protection of the marine environment
- Using leadership and managerial skills

Instructors should refer to these when designing the assessment of each competence of this CoC.

It is consistent with the intent of the STCW that demonstration of skills and practical understanding be determined by direct observation, while knowledge and theoretical understanding be determined through written examination with a variety of question types.

One option is to consider these written examinations not in the evaluation session, but in the briefings and debriefings as the sum of different short tests for assessing different skills/knowledge. On the other hand, the time for the evaluation should be 2 hours for a complete simulation of all competences required for this CoC, and one hour for the assessment of the theoretical knowledge.

Assessment Planning
The training and assessment of seafarers required under the Convention are administered, supervised and monitored in accordance with the provisions of Regulation I/6 of the STCW Convention.

Assessment planning should be specific, measurable, achievable, realistic and time bound (SMART). Some methods of assessment that could be used depending upon the course/ qualification are as follows and all should be adapted to suit individual needs:

- observation (in oral examination, simulation exercises, practical demonstration);
- questions (written or oral);
- tests;
- simulation.

According to the objective of this CoC, notwithstanding the additional methods for assessing the above competences, the main assessment method is based on simulations, using all simulators where trainees have worked.

Validity
The evaluation methods must be based on clearly defined objectives, and must truly represent what is meant to be assessed; e.g. only the relevant criteria and the syllabus or course guide. There must be a reasonable balance between the subject topics involved and also, in the testing of trainees' KNOWLEDGE, UNDERSTANDING AND PROFICIENCY of the concepts.

Reliability
Assessment should also be reliable (if the assessment was done again with a similar group/learner, similar results would be achieved). Different groups of learners may have the same subject at different times. If other evaluators are also assessing the same course/qualification, it is necessary to ensure that all are making the same decisions. In order to be reliable, an evaluation procedure should produce reasonably consistent results, no matter which set of papers or version of the test is used.

If instructors are assessing their own trainees, they need to know what to assess and then decide how to do this. The "what" will come from the standards/learning outcomes of the course/qualification they are delivering and the "how" may be decided whether it is with assignments, tests or examinations.

The instructors need to consider the best way to assess the skills, knowledge and attitudes of their learners, whether this will be formative and/or summative and the validity and reliability of the

assessment. As it has been indicated, for this CoC, the main assessment method is based on simulations, using all simulators where trainees have worked. Notwithstanding, other methods shall apply.

All work assessed should be valid, authentic, current, sufficient and reliable; this is often know as VACSR – "valid assessments create standard results":

- valid: the work is relevant to the standards/criteria being assessed;
- authentic: the work has been produced solely by the learner;
- current: the work is still relevant at the time of assessment;
- sufficient: the work covers all the standards/criteria;
- reliable: the work is consistent across all learners, over time and at the required level.

It is important to note that no single method can satisfactorily measure knowledge and skill over the entire spectrum of topics to be tested for the assessment of competence. Therefore, care should be taken to select the most appropriate method to the particular aspect of competence to be tested, bearing in mind the need to frame questions which relate as realistically as possible to the requirements of the officer's tasks at sea.

Compiling assessments

Whilst each examining authority establishes its own rules, the time which can be devoted to assessing the competence of candidates for certificates of competency is limited by practical, economic and social restraints. Therefore a prime objective of those responsible for the organization and administration of the assessment system is to find the most efficient, effective and economical method of assessing the competency of candidates. An examination system should effectively test the depth of a candidate's KNOWLEDGE, UNDERSTANDING AND PROFICIENCY of the subject areas pertinent to the tasks he/she is expected to undertake. It is not possible to examine candidates fully in all areas, so in effect the assessment samples a candidate's KNOWLEDGE, UNDERSTANDING AND PROFICIENCY by covering a scope as wide as possible within the time constraints for testing his/her depth of KNOWLEDGE, UNDERSTANDING AND PROFICIENCY in the selected areas.

Thus, in the 3 hours devoted to evaluation, the simulations shall ensure the candidate's knowledge, understanding and proficiency of all the subject areas defined which correspond to the STCW Code competences.

The assessment as a whole should assess each candidate's comprehension of principles, concepts and methodology; ability to apply principles, concepts and methodology; ability to organize facts, ideas and arguments and abilities and skills in carrying out the tasks to perform the duties he or she is to be certificated to undertake.

All evaluation and testing techniques have their advantages and disadvantages. Examining authorities should carefully analyse what they should test and could test. A careful selection of test and evaluation methods should then be made to ensure that the best from the variety of techniques available today is used. Each assessment shall be that which best suits the learning outcome or the ability to be assessed.

Quality of test items

No matter which type of test is used, it is essential that all questions or test items used should be as brief as possible, since the time taken to read the questions themselves lengthens the examination. Questions must also be clear and complete. To ensure this, it is necessary to do peer review. Furthermore, no superfluous information should be incorporated in the questions.

Exam-exercise

In the assessment planning, it has been established that the main method for assessing competences is the use of simulators. Then, for an exam model, it is necessary to specify:

- Subject Area time
- Subject Area contents
- Subject Area simulator/s

Depending on the time available, maybe not all items of each competence should be evaluated, but as it has been indicated in the Compiling assessments, the simulations must guarantee the candidate's knowledge, understanding and proficiency on all subject areas defined, in order to ensure that the main competences of the STCW Code are assessed.

The exam shall be a sum of shorter exercises. For example: a ship is sailing and some situations occur; then, this ship berths, and when berthed, she discharges her cargo and she is going to load another cargo; then, in one of these operations, an emergency occurs. The different situations shall provide a wide range of exam exercises. It is important to have a variety of exams, which correspond to different situations so that the student *can* randomly choose one of them.

For the competences which cannot be evaluated in a simulation session, three possibilities should be considered:

- During the briefings and debriefings, different short tests for assessing different skills/knowledge should be proposed. The sum of all of these short exams should provide a complete exam for all these competences.
- Sometime should be devoted to the evaluation by simulator (for example 2 or 2.5 hours) and the rest of time to the assessment of the theoretical knowledge (1 or 0.5 hours).
- Some theoretical questions should be incorporated in the exam-exercises that the candidate, during the simulation and between two expected student actions, could ask some of the questions found during the simulation.

Annex I: Example Scenario

In the following pages, we attach an example scenario considering Part D. Instructor Manual section:

Course: CoC Revalidation Course

Title: Entering Dover Strait early in the morning (near F3 buoy)
Own ship: Passenger ship.

No: Management 3.4

References:
- Bridge Watchkeeping (Nautical Institute ISBN 1870077172)
- Bridge Team Management (Nautical Institute ISBN 1870077660)
- Mariners Handbook.
- Collision Regulations (COLREGS).
- Standard Marine Communication Phrases (SMCP).
- STCW: Table AII/2 c1-1, c1-2, c1-3, c1-4

Duration:
- Briefing: 30 minutes.
- Simulator run:60 minutes.
- Debriefing: 30 minutes.

Objectives / competences:
- This exercise trains the student with:
- Determine position and the accuracy of resultant position fix by any means
- Determine and allow for compass errors.
- Establish watchkeeping arrangements and procedures.
- Maintain safe navigation through the use of information from navigation equipment and systems to assist in command decision making.

Prerequisites:
- Basic theoretical navigational knowledge.
- Knowledge of COLREGS.
- Basic radar/ARPA knowledge.

Training materials:
- Full Mission Bridge Simulator (including all navigational equipment).
- Overhead sheets and/or PowerPoint presentation.
- - Charts to be used: BA 323 and BA 2449.
- Checklists.
- Chart handling tools.
- Pilot card (ship's particulars and manoeuvring tests).
- All relevant nautical publications (British and Local).

Initial condition simulator:
- Type of ship: Passenger ship
- Initial position: 051º 34.60 N 002º 07.80 E
- Start time: 00.20 UTC.
- Tidal stream: 032°@2.0 kn

- Initial course: 220° True.
- Initial speed: 17.0 knots.
- Engine status: full manoeuvring speed.
- i.c. gyro compass: + 0.0°.
- Wind dir. and speed: E 3 Bft.
- Visibility: 8 – 10 NM.
- Targets: see list of targets.
- Radars: on.

Target ships in exercise:	**Position:**		**Course/speed:**
Ever Decent	051º 35.71 N	001º 49.42 E	151.7 / 20.0 kn
Clary	051º 31.30 N	001º 42.30 E	083.0 / 14.0 kn
Kon. Juliana	051º 36.53 N	001º 47.86 E	153.6 / 20.0 kn
Leliegracht	051º 34.30 N	002º 00.70 E	205.0 / 10.5 kn
Jo Oak	051º 31.70 N	002º 04.80 E	216.0 / 13.0 kn
Balticborg	051º 29.10 N	002º 02.80 E	224.0 / 9.6 kn
Norman Maas	051º 30.50 N	002º 06.80 E	222.0 / 10.5 kn
Hamburg Express	051º 24.80 N	002º 05.90 E	305.5 / 22.5 kn
HAM 318	051º 21.90 N	002º 14.80 E	296.0 / 15.0 kn
VLI 3	051º 24.70 N	002º 07.00 E	291.0 / 9.0 kn
Ladon	051º 25.35 N	001º 56.45 E	225.0 / 12.0 kn
Maingas	051º 17.50 N	002º 06.85 E	024.0 / 16.0 kn
Sericata	051º 25.24 N	002º 05.37 E	042.0 / 8.0 kn
Normand Drott	051º 24.13 N	002º 58.67 E	225.5 / 13.0 kn
Californian Highway	051º 15.92 N	002º 05.44 E	006.8 / 18.0 kn
Berge Duke	051º 10.61 N	001º 45.58 E	049.3 / 12.0 kn
Mitra	051º 16.79 N	001º 54.53 E	042.0 / 10.0 kn
Othello	051º 06.98 N	001º 47.48 E	059.6 / 15.0 kn
Sentinel	051º 10.28 N	001º 54.32 E	060.7 / 14.0 kn
Leopard	051º 12.43 N	002º 02.06 E	045.0 / 13.1 kn
Maersk Fighter	051º 11.49 N	002º 00.38 E	061.0 / 12.0 kn
Z 34	051º 13.93 N	002º 00.05 E	042.6 / 2.5 kn
Deurne	051º 03.14 N	001º 42.44 E	046.4 / 9.5 kn
Patty	051º 07.92 N	001º 46.25 E	062.5 / 14.0 kn
Silverbridge	051º 04.68 N	001º 39.81 E	050.9 / 14.0 kn
Cast Coastal	050º 59.75 N	001º 35.96 E	044.5 / 14.0 kn
Tertnes	051º 06.74 N	001º 41.77 E	061.0 / 12.0 kn
Fighter	051º 11.28 N	002º 00.98 E	062.4 / 4.0 kn
Elbe Trader	051º 11.13 N	002º 00.60 E	062.2 / 4.0 kn
Matadi	051º 08.26 N	001º 54.10 E	062.3 / 12.0 kn
Trollnes	051º 12.39 N	001º 58.59 E	060.7 / 12.0 kn
Nestefox	051º 14.80 N	002º 03.34 E	039.0 / 14.0 kn
Warrior	051º 11.15 N	001º 47.58 E	045.5 / 18.0 kn

Briefing:

- Plan voyage as indicated by instructor.
- Vessel is heading for Dover and is entering precautionary area near F3 buoy.
- Comply with the regulations and sail the vessel save through the TSS.
-

Student action:

During briefing

- Prepare the exercise, using all available training materials.
- Anticipate the traffic density.

During exercise

- Check position and monitor track of own ship.
- Check bearing and CPA of target vessels.
- Install Parallel Index lines on radar.
- Take action for small CPA according to COLREGS.
- Process information from Vessel Traffic (Information) Stations, by VHF and/or Navtex.
- Observe light configurations to determine the ship's status in relationship to the COLREGS.

Instructor action:

- Before starting the simulation hand over the Watch and point out the traffic.
- Point out targets on the radar.
- Monitor and observe students and ascertain if objectives are met.
- Monitor conversations in relation to the SMCP.
- Deal with all targets according to COLREGS.
- Check if students:
    - Anticipate on developing situation
    - Use Parallel Index lines properly.
    - Use Standard Marine Communication Phrases.
    - Process incoming information properly.
    - Deal with COLREGS.

Debriefing:

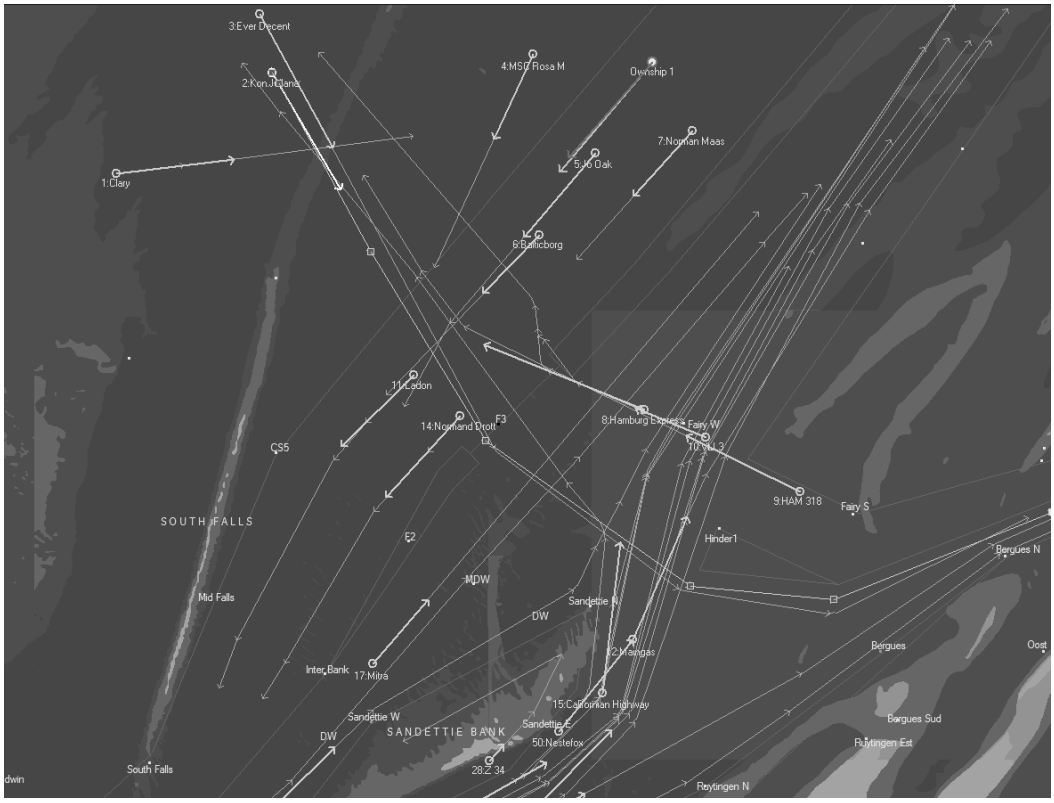
- Reiterate objectives and check if they are met.
- Point out positive actions.
- Start a discussion by means of peer review.
- Play back the exercise and discuss the ship's movements.
- Summarise students' actions and conclusions.
- Point out positive actions.
- Discuss points for improvement.
- Check if positions are properly noted in the chart(s).
- Show students what can be the result of a poor watch.

- Discuss the advantages or disadvantages of sailing in the dark.

Evaluation:

Discuss with students:

- The circumstances of sailing in congested waters.
- Dealing with advise from VT(I)S
- Observations made on ARPA
- Use of trial manoeuvres
- Effect on the engine speed during manoeuvring
- Use of Maritime Resource Management on board ships



Management level exc. OP. 3-4 (Watchkeeping)						
A	**B**	**Particulars**	**Expected student action**	**Expected action instructor**	**Text**	**Instructor guidelines**
		Exercise Philosophy: The accent in this exercise is to anticipate towards the dangers of sailing in a TSS during night hours and early morning. The students have to combine the information from the radar screens, outside views and VHF input.				
-05:00	--	Preparing the bridge for the coming exercise.	Student checks and prepares all instruments. Input in all relevant instruments like ECDIS, RADAR PI	Checking if all instruments are set properly	None	
-03:00	--	Handing Over of the Watch	Apprehend watch hand over	Students are handed over their task specific watch particulars. Check if radars are prepared well.	Check if students are fully capable of performing their duties, particularly their adjustment to night vision.	Make sure the OOW confirms to **"have the watch"**
00:00	220/17.0	Start voyage through DW route	Students have to check shipping relevant for them.	Check current= 030-2.0 Check wind= E'ly 3 Bft Check waves= enable		Act for some time as Dover Coastguard or ships in vicinity of own vessel
+01:00	220/17.0	Ownship is overtaking unidentified vessel which is joining the separation lane.	Students should make a plot from ships in vicinity. Students have to identify ships crossing TSS and ships in the NE and SW traffic lane.	Instructor has to act as Dover Coastguard receiving and transmitting messages from shipping in SW lane.		
+03:00	220/17.0		OOW should suggest course according information from other ships		--	Observe students actions on the bridge. (use video do demonstrate in debriefing)
+06.00	212/17.0	Ownship is changing course to come to the centre of the faiway	OOW is changing course to 212			
+20.00	212/17.0		Students by now should have noticed the risk of collision with Maider.			Have a close watch of discussion what to do with the target
+22.00	212/17.0	Crewmember coming to the bridge for signing papers concerning garbage record book.	This should cause a distraction of the OOW.	Ship on collision course from Port is altering course.		
+29.00	212/17.0	Ownship is called by unidentified vessel	Students should take action to avoid collision. (If target doesn't react according to Colregs)	VHF 16: *Passenger Ship approaching Foxtrot Freeboy, course 215, please.*		Make a note for discussion about actions taken by the student.
+35.00				If collision occurs instructor has to act as officer Maider vessel		Watch closely the actions taken by the students to avoid the collision.

Column A: Time χ min: sec (before) – or (after) + the start of the exercise.

Column B: Expected gyro course and water speed of own ship.

Attachment

ATTACHMENTS.

Model course to demonstrate and revalidate deck officers' competences by using simulators

This part contains records of meetings with research partners during the project and handouts of presentations and research dissemination.

MEETINGS MINUTES

According to the Gantt Chart presented in the application form, we have carried out the following meetings:

1. Kick off meeting. Minute meeting of the initial virtual Skype meeting

Date: 11th January 2013.

Assistants:

Members of the Maritime Institute Willem Barentsz (MIWB)
Members of the Admiral Ushakov Maritime State University (AUMSU)
Members of Barcelona School of Nautical Studies (FNB)

Agenda meeting:

1. Budget.
2. General view of the research project (work packages).
3. Deadlines and work from now to May 2013.
4. Fixing the date of the initial meeting at Maritime Institute Willem Barentsz in Netherlands.

1. Budget.

FNB has explained how it is going to manage the budget as a coordinator university, each partner has its own budget according the tasks assigned.

2. General view of the research project (work packages)

Partners have revised the work packages of the Project, timing and Gantt chart. WP1 and WP2 start at the same time (May 2013) and finish in July 2013. With the results obtained in July 2013, WP3 will start as the main part of the Project.

3. Deadlines and work from now to May 2013

Before starting the real date of the Project, each institution will present a report identifying current national courses to revalidate seafarers CoC if it has expired in its country. The deadline for this will be 31st March 2013.

AUMSU will also prepare a general email to send to the IAMU institutions asking for the current national courses and will analyze all these courses in order to identify the best practices. The deadline of this will be 30th April 2013. At the same time, MIWB will present a report analyzing competences required by STCW'10 in order to evaluate which can be assessed using simulation technology.

In the middle of February, FNB will prepare the general format of the oncoming reports.

4. **Fix the date of the initial meeting at Maritime Institute Willem Barentsz in Netherlands.**
   MIWB will send by email a proposal for the first meeting at the Maritime Institute Willem Barentsz in May. 13-15 of May is proposed and confirmed by the other institutions after the meeting.

2. Minute meeting of the initial meeting at MIWB, The Netherlands.

Date: 16-17th May 2013

Assistants:
C. Muijskens, W.J. Hofman and S.J. Cross (MIWB)
S.Ordás and M. Castells (FNB)

Agenda meeting:

1. Opening
2. Current state of the project (Final approval IAMU and Letters of commitment)
3. General format of the project
4. Evaluation of the outcome of WP 1 (identify the current national refresher and updating courses. Skype meeting with AUMSU. (15.30-16.00)
5. Discussion of WP2 and WP3. How to implement these WP's (best way of working)
6. Deadlines and work from May to July.
7. Next meeting

Meeting at Maritime Institute "Willem Barentsz" called to order 13.30, 16th May.

1. Opening.
Cees Muijskens has opened the meeting.

2. Current state of the project (Final approval IAMU and Letters of commitment)
FNB has explained that IAMU has sent the final consignment contract between IAMU and Barcelona School of Nautical Studies (FNB) and a copy of the contract has been given to the MIWB partner. A new copy with the signatures will be sent by email later.
The coordinator has received the letter of commitment of Maritime Institute Willem Barentsz. Letter of commitment of Admiral Ushakov Maritime State University hasn't been received yet.
The coordinator part has drafted a consortium agreement between FNB and MIWB and AUMSU relating to the research project entitled "simulation-based model course to demonstrate seafarers' competence" and has explained how it is going to manage the budget as a coordinator university and the responsibilities of each part in this research project. The consortium agreement has been signed by UPC (FNB) and MIWB part. The consortium agreement will be delivered in person at AUMSU part if finally, someone of the coordinating group attends the 1st Conference Black Sea Association of Maritime Institutions "BSAMI 2013" (2013, 25th – 27th June), if not, the consortium agreement will be sent by courier.
Finally, we have discussed about next Call for Research Proposals for FY2014. A draft proposal will be send by FNB considering marine engineers discipline (revalidation of CoC for engineers) as a 2-year research project (continued project).

3. General format of project

The general format of the research project has been discussed and finally the following structure has been decided: the project will consist of three parts:

1. A general report of the research project with the format sent by the coordinator part will be drafted. This general report will have the same structure of the IAMU final reports.
2. A model course with the structure similar to IMO model course will be drafted. This "IAMU model course" will deal ONLY with the competences that can be evaluated through the simulators (conclusions obtained in WP2). The rest of competences could be evaluated in a future research project.
3. A set of simulator-based exercises scenarios will be designed and will be attached at the end of the project.

4. Evaluation of the outcome of WP 1 (identify the current national refresher and updating courses. Skype meeting with AUMSU. (15.30-16.00)

First report of WP1 has been discussed and the main drawback is the difficulty of reading and obtaining clear conclusions. Finally, a questionnaire will be drafted and will be sent to the rest of IAMU's institutions. The questionnaire will have few questions quick to respond. The main objectives of this survey are: to get more responses from different institutions and secondly to obtain clear conclusions from figures and statistics of WP1. Questionnaire is draft in 2013, 17th May, during the meeting and will be sent to AUMSU University for the final approval. Once the questionnaire is finished, AUMSU University will introduce the questionnaire in an online tool and will send it to the IAMU's institutions as soon as possible.

The final report of WP1 presented by AUMSU should follow all chapters of the original format sent by the coordinator. Results and conclusions of WP1 will depend on the answers of the questionnaire and will be, basically, figures on statistical results.

5. Discussion about WP2 and WP3. How to implement these WP's (best way of working)

MIWB partner has presented an index of work for WP2 and it has been discussed. Main results of WP2 should find which maritime competences required by STCW Code can be assessed using simulation technology. These results will be the starting point of WP3.

Meanwhile, FNB will start to work in the main structure of model course (WP3) following the standard IMO format. This WP will start, officially, in August 2013.

6. Deadlines and work from now to July 2013

Final reports of WP1 and WP2 must be presented at the end of July (31st), for that reason, these work-packages should be presented on 15th July to the rest of the partners to discuss and exchange comments.

7. Next meeting

According to the proposal, the next meeting should be done at Admiral Ushakov Maritime State University in October (23th-24th), but the Presentation of interim report must be done in the 14th Annual General Assembly of the IAMU, Constanta Maritime University, Romania, October 26th-28th 2013. For that reason, this meeting will be carried out before (October 2nd-4th, 2013), if AUMSU partner agrees.

Meeting at Maritime Institute "Willem Barentsz" finished at 11:30, 17th May,

3. Minute meeting of the intermediate meeting at Amsterdam

Date: 17-18th October 2013.

Location: Amsterdam
Assistants:
C. Muijskens (MIWB)
S. Ordás and M. Castells (FNB)
Skype meeting with AUMSU during the meeting

Agenda

1. Opening
2. Current state of the project
    a. WP1 and WP2
    b. Status and discussion about WP3, model course
    c. Status of WP4: define how many exercise scenarios should be provided.
3. Presentation at AGA14 (October 2013)
4. Deadlines and work from October to December
5. Next meetings

Meeting at Amsterdam called to order 12.00, October 17th, 2013.

1. Opening.

Cees Muijskens opens the meeting.

2. Current state of the project

a. WP1 and WP2

WP1 and WP2 were presented in 31st July 2013. Both of them are commented and completed.

b. Status and discussion about WP3, model course

This is the main part of the meeting. Before the meeting, all partners have received the first draft of WP3 to be discussed during the meeting in Amsterdam. Taking point 8 of WP2 as the starting point, 26 competences may be evaluated by using simulator (66.7%) considering

the legal basis found in *column 3. Methods for demonstrating competences.* In all cases, one of the modalities is: approved simulator training, where appropriate. Therefore, from the 26 competences evaluable with simulator, not all knowledge in each of these competences is evaluable by simulator and all of them have been. Finally, the following competences should be checked as soon as possible:

- Operational level:
  FNB will check the "notes" Competence 3 and 4 according to New Manila STCW Code.
  MIWB and AUSMU will check competence 7
  MIWB and AUSMU will check if competence 10 can be evaluated during the briefing or in the theoretical test. If during the briefing, explain how it can be done.
  Competence 11, part of ship construction (a) can be evaluated with support material during the briefing (for instance with an explanation of how is the general structure of the ship, her distribution…): in this case, competence 11 can be evaluated by simulator and some changes should be done at the end of this section.
- Management level:
  FNB will check the notes Competence 17 and 18 according to New Manila STCW Code.
  MIWB and AUMSU will check if competences 24, 26 can be evaluated by simulator
  Once all these competences will be checked, section 5.3.2 of WP3 will be completed and total percentages and conclusions (section 5.3.3) will be modified.
  Finally, the structure of the model course is discussed (section 5.4 Structure of the model course). The general structure of the model course will be divided into 7 sections: first one will be a section of familiarization with simulators and other six sections will be different kind of exercises. One single exercise can assess different competences. Every section will be subdivided in two levels: operational and management.

Operational: 7 sections x 3 standard exercises = 21 standard exercise scenarios
Management: 7 sections x 3 standard exercises = 21 standard exercise scenarios
At the end of the research project we will present a total of 42 standard exercise scenarios.
Each exercise will be divided into three main parts: briefing/simulation/debriefing (as we stated, some competences can be evaluated during the briefing and debriefing).
To conclude, the duration of the course is also discussed: each exercise will take 2 hours (0.5 briefing/1 simulation/0.5 debriefing). Therefore, the duration of the model course will last around 42 hours for operational level and around 42 hours for management level.

c. Status of WP4: define how many exercise scenarios should be provided.
Once the competences are checked, FNB will design, considering these seven sections (Familiarization, Planning a voyage, Watchkeeping, Manoeuvering, Cargo handling, Emergencies and rescue, controlling the operations) a table considering the competences that should be evaluated in each section (standard exercise) and MIWB will start to design the exercises that should be provided at the end of March, 2014.

3. Presentation at AGA14 (October 2013)
First draft of the PowerPoint presentation that will be presented in the 14th Annual General Assembly of the IAMU, Constanta Maritime University, Romania, October 26th-28th, 2013 is discussed during

the meeting. The final presentation will be sent by email to all partners the following week for final comments.

4. Deadlines and work from October to December

FNB will work and finish WP3 at the end of December. MIWB will start to design the Simulator-based exercises test considering the standard exercises scenarios described in WP3.

5. Next meetings

According to the proposal, next (and final) meeting will be carried out at Barcelona School of Nautical Studies in May 2014. The final presentation (workshop) of the research project will coincide with the annual meeting of the CESMA (Confederation of European shipmasters associations) that will be held on May, 16th-18th, 2014. So the final meeting of this research project will be carried out in May, 15th and 16th, 2013 in Barcelona.

On the other hand, WP3 will be finished on 31st December 2013 and the next skype meeting will be in February 2014 to comment and discuss this WP and new WP4.

Meeting finished at 10:30, 18th October

4. Minute meeting of the virtual Skype meeting.

Date: 3rd February 2014 at 10:00 (Spanish time)

Assistants:

Members of the Maritime Institute Willem Barentsz (MIWB)
Members of the Admiral Ushakov Maritime State University (AUMSU)
Members of Barcelona School of Nautical Studies (FNB)

Agenda meeting:

1. Current state of the project
2. Summary Report for Research Project FY2013
3. Next meeting (Skype meeting)
4. Last meeting at Barcelona School of Nautical Studies (15th and 16th May 2014 in Barcelona)
5.

1. Current state of the project

WP3 to be completed, comments and discussion: FNB explains how WP3 has been developed. This work package finally has 3 different documents:

a) Document with the explanation of the "design a revalidation model course structure": first of all, analysis of competences described in chapter II part A of STCW code 95/2010. The 26 competences evaluable by using a simulator have been divided into operational level and management level. The second stage is determining the knowledge required for each of the 26 competences and the type of simulator to be used. If a knowledge aspect is evaluable by using additional material apart from the simulator, this is indicated as Supporting Material (SM) and in other cases, "it depends on the simulator". Finally the main structure of the revalidation model courses is described. For each level (operational and management) it is possible to do some long exercises, so Table 1 (page 33) shows the main structure for the course considering 7 different exercises and competences to be evaluated.

b) Revalidation simulation-based model course (operational level – deck department)
c) Revalidation simulation-based model course (management level - deck department)

According MIWB partner comments, we have introduced "deck department" in the title of the operational and management courses, because it's necessary to make a distinction with the marine engineering department.

According AUMSU partner, we have introduced IMO Model Courses 3.12 and 6.10 in the "staff requirement" section of both model courses and in the bibliography.

As can be observed, these model courses have been developed following the model course structure adopted by the IMO. Parts E and D of the model courses are not finished because it depends on the progress of WP4, at the end of the March, 31st 2014, it will be completed by FNB.

Status of WP4: MIWB is the leader of this work package. As we defined previously, a total of 42 standard exercises should be developed (2 level*7exercises*3examples). Part B (page 14) of the model courses, *Course outline and Timetable*, presents the description of the course more deeply. We should follow this timetable when designing the exercises, if some changes are necessary, it can be changed in the model course. MIWB will present at the end of this week one example exercise for comments. AUMSU can give support testing exercises presented by MIWB.

2. Summary Report for Research Project FY2013
We must submit the summary report to the Secretary's Office by the end of March 2014. So, FNB will fill the summary report format and will send it to the other universities before we send it to the IAMU Secretary's Office. The submission deadline is 31st March 2014 with UPC rector's signature.

3. Next meeting (Skype meeting)
From February to the end of March, Part D and E of model courses, 42 exercises and summary report should be completed. At the end of March/beginning of April a new skype meeting should be decided in order to describe how WP5 (Review and discussion) will be developed. 7th April, 2014 at 10:00 (Spanish time) is proposed and accepted.

4. Last meeting at Barcelona School of Nautical Studies
Last meeting will be held at Barcelona School of Nautical Studies on 15th and 16th of May 2014. We will present our research project during the Annual General Assembly of CESMA (Confederation of European Shipmasters' Associations) Meeting that will be held as well in our School. AUMSU will send the list of participants in this meeting in order to prepare an invitation letter for them.

5. Minute meeting of the virtual Skype meeting
Date: 7th April 2014 at 11:00 (Spanish time)

Assistants:
Members of the Maritime Institute Willem Barentsz (MIWB)
Members of the Admiral Ushakov Maritime State University (AUMSU)
Members of Barcelona School of Nautical Studies (FNB)

Agenda meeting:

1. Current state of the project
    a. Summary Report for Research Project FY2013 delivered
    b. Part D and E of the model course
    c. Status of WP4
2. Start of WP5: Review and discussion. Final report (31st May 2014)
3. Research Presentations and dissemination
4. Second payment

1. Current state of the project

a. Summary Report for Research Project FY2013 delivered

Summary Report with the signature of our rector was sent via email last week to the IAMU secretariat office.

b. Part D and E of the model course

FNB has developed part D (Instructor Manual) and Part E (Evaluation and Assessment) of the model course. The Instructor Manual defines the structure of exercises scenario based on the model sent by MIWB. Contents and objectives of each section are described. An example is attached considering these sections in Part D. Part E is similar to other IMO model courses, just some specific items related to revalidation model courses are introduced. Final revalidation model courses will be sent to MIWB and AUMSU for the final acceptance.

c. Status of WP4

MIWB is working on simulation exercises and all of them will be sent via dropbox at the end of next week or after Easter holidays for final comments. Familiarization exercises will be the same for both, operational and management level. So finally, a total of 39 exercises will be presented as a result of WP4 instead of 42.

2. Start of WP5: Review and discussion. Final report (31st May 2014)

IAMU's secretariat has sent the guidelines for the final report. However, they are considering improving the guidelines of the final report and it will be discussed and concluded at the IEB meeting on 15 April. If the guidelines are modified, they will inform the coordinators of the research projects FY2013. We will wait for the final guidelines to start with the final report. The final report will be written by FNB.

3. Research Presentations and dissemination

A research project will be presented during the 6th International Conference on Maritime Transport by FNB partner. The final paper presented will be sent to the parties before the conference. Moreover, MIWB partner will present this research project at International Navigation Simulator Lecturers' Conference (INSLC 18) at Massachusetts Maritime Academy next September 2014.

4. Second payment

According to the consortium agreement, the order for second payment is done. The final payment will be transferred to the parties after the final IAMU's payment and the final report will be presented.

Finally, MIWB partner suggests in his last email to discuss about the title of the course. Currently the title of the course is: Revalidation simulation-based model course (deck department) and his suggestion is: Simulation-based model course to revalidate seafarers' competences. This item will be discussed during last meeting in Barcelona.

Meeting has been finished at 11:30, 7th April 2014

6. Minute meeting at Barcelona School of Nautical Studies

Date: 15-16th May 2014
Location: Barcelona School of Nautical Studies

Assistants:

- C. Muijskens and W.J. Hofman (MIWB)
- A. Boran-Keshishyan and P. Anatoliy (AUMSU)
- S.Ordás and M. Castells (FNB)

Agenda meeting:

1. Opening
2. Current state of the project
3. Final report
4. Presentation at conferences: MT14, INSLC 18 and AGA15
5. Budget
6. Proposal to the next call FY2015

Meeting at Barcelona School of Nautical Studies called to order 15:00, 15th May 2014.

1. **Opening.**
   M. Castells opens the meeting.

2. **Current state of the project**
   WP3 and WP4 have not been completed yet. In WP3, a discussion on whether to include particular examples of exercises/scenarios is carried out. All partners should revise parts D and E of the model course. Related to WP4, part 7 is still missing, but most of it is in the operational level. The same scenario as that of cargo-handling can be used but introducing watertight integrity. To assess the leadership competence some bridge team exercises could be incorporated. These new scenarios will be sent at the beginning of next week.

3. **Final report**
   Final report should consists of the following parts:

   - Executive summary (max 2 pages), as this part will be sent to the IEB members for the final approval, a separate document file of your executive summary is needed.
   - The main report (40 – 70 pages). This part should follow the format given as Form 4.
   - Attachments (20 pages maximum). This part contains records of meetings with your research partners, handouts of your presentation at AGA and other related documents related to your project.

Related on the Executive summary it should include the conclusions of each workpackage and some main conclusions. The main report is currently very long and we have to reduce the number of pages, so there's a discussion of which sections from parts 1, 2 and 3 should be left out. A possibility to reduce number of pages would be to refer to the STCW competences without describing them. We can post the whole document on the intranet website so that it is available for those who to carry out the course. The two model courses should be kept as they are the result of the research. The scenarios should be included in the annexes concerning the exercises. A couple of examples for the operational and management level should be included in the model courses and the rest should be in the annexes.
We must submit the final research project to Secretary's Office as a pdf file and MS world file attached to an e-mail no later than 31st May 2014.

4. Presentation at conferences: MT14, INSLC 18 and AGA15

FNB and MIWB partners will present the results and conclusions of the research project at three different conferences: MT14, INSLC 18 and AGA15

Results of the research Project will be presented at three different conferences:

- MT14 Conference at Maritime Museum of Barcelona next June 2014.
- International Navigation Simulator Lecturers' Conference (INSLC 18) at Massachusetts Maritime Academy next September 2014.
- AGA15

According with the consignment contract (point 6): *The contractor may publish the Project results, provided that IAMU agrees to this and the following sentence is printed in the publication: "The materials and data in this publication have been obtained through the support of the International Association of Maritime Universities (IAMU) and The Nippon Foundation in Japan",* and include the official logos of the IAMU and The Nippon Foundation which will be provided by the Secretary's Office.

5. Budget

The remainder of payment (40%) will be paid upon receipt of the invoice from the contractor on the premise that IAMU's IEB approves the results of the project.

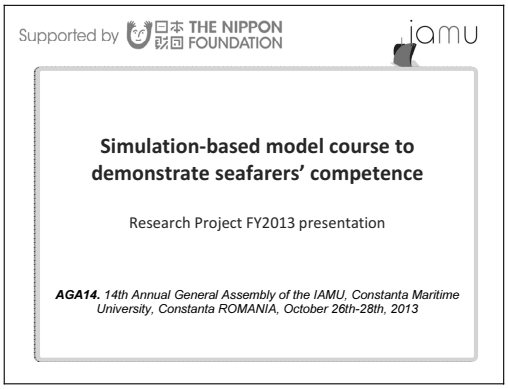
6. Proposal to the next call FY2015

A new proposal will be prepared to be presented at the next call FY2015. According to the IAMU assessment result of the last call FY2014, a new partner of non-European member with expertise in simulation marine engineer discipline will be contacted. New topics of the new proposal are discussed. The title of new proposals should be: Simulation-based model course to demonstrate seafarers' competence for marine engineer's discipline (2 year research proposal, continued proposal)

Meeting Barcelona School of Nautical Studies has been finished at 12:00, 16th May, 2014

PRESENTATIONS AND RESEARCH DISSEMINATION

1. Presentation at AGA14, 14th Annual General Assembly of the IAMU, Constanta Maritime University, Constanta ROMANIA, October 26th-28th, 2013.



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Main Research Objectives

Design the contents of a model course using simulation technology to assessment of seafarers' competence in accordance with provisions of STCW Code for existing marines who need upgrade their professional maritime certificates.

4

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Specific Research Objectives

- Develop a common academic programme using simulation technology.
- Promote the implementation, development, harmonisation and unification of the maritime programme contents considering international standards for training of seafarers.
- Prepare a publication, as a guidance tool, of the model contents to demonstrate marine certification competence.

5

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Meetings

- Initial meeting at Maritime Institute Willem Barentsz, West-Terschelling (The Nehterlands). 16-17th May 2013
- Intermediate meeting at Amsterdam (The Nehterlands). 17th October 2013

6

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Work packages (WP)

WP1: Identify current national refresher and updating programmes courses

WP2. Study of the application of simulation technology

WP3. Design a model course structure

WP4. Simulator-based exercises test

WP5. Review and discussion

7

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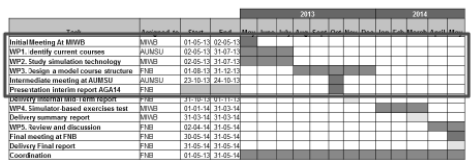

Task	Assigned to	Start	End
Initial Meeting At MIWB	MIWB	01-05-13	02-05-13
WP1. identify current courses	AUMSU	02-05-13	31-07-13
WP2. Study simulation technology	MIWB	02-05-13	31-07-13
WP3. Design a model course structure	FNB	01-08-13	31-12-13
Intermediate meeting at AUMSU	AUMSU	23-10-13	24-10-13
Presentation interim report AGA14	FNB		
Delivery internal mid-term report	FNB	21-10-13	01-11-13
WP4. Simulator based exercises test	MIWB	01-01-14	31-03-14
Delivery summary report	MIWB	31-03-14	31-03-14
WP5. Review and discussion	FNB	02-04-14	31-05-14
Final meeting at FNB	FNB	30-05-14	31-05-14
Delivery Final report	FNB	31-05-14	31-05-14
Coordination	FNB	01-05-13	31-05-14

8

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WP1. Identify current national refresher and updating programmes courses

1. Detailed current programs in English required: **7 answers**

   (Spain, Portugal, India, Mexico, The Netherlands, United Kingdom, Russian Federation)

2. Questionnaire: **22 answers** (39% of the IAMU memberships)

   (Spain, The Netherlands, United Kingdom, Russian Federation, Australia, USA (3), Croatia (2), Bulgaria, Estonia, Germany, Philippines (2), Ukraine, Venezuela, Vietnam, Turkey (2), Rumania, Greece)

9

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WP1. Identify current national refresher and updating programmes courses

1. 3 of them don't have a revalidation program for CoC in their institutions: **19 answers**
2. All of them have approved revalidation program for CoC by their government

10

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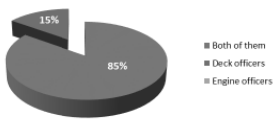
WP1. Identify current national refresher and updating programmes courses

Which kind of course do you assess?



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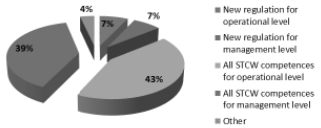
WP1. Identify current national refresher and updating programmes courses

Which kind of topics do you assess?



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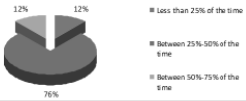
WP1. Identify current national refresher and updating programmes courses

From 19 Institutions, 17 uses simulators in the CoC revalidation course. 8 institution use all type of simulator.

Navigational simulator	17
GMDSS simulator	13
Cargo handling simulator	11
Engine room simulator	12

How much time do you devote to the use of simulators on the revalidation course?



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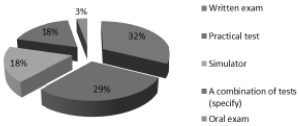
WP1. Identify current national refresher and updating programmes courses

Which of the following types of assessment do you use to evaluate the course participants?



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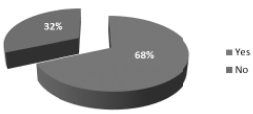
WP1. Identify current national refresher and updating programmes courses

Is the material of the course available online?



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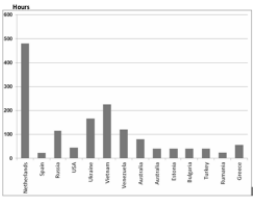
WP1. Identify current national refresher and updating programmes courses

What is the duration of the course?



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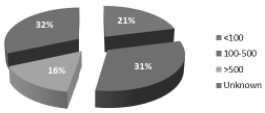
WP1. Identify current national refresher and updating programmes courses

How many people are applying for revalidation course per year?



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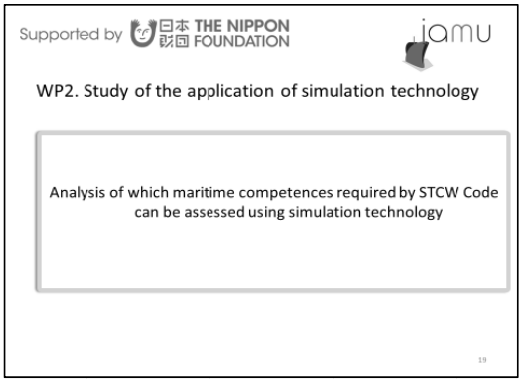
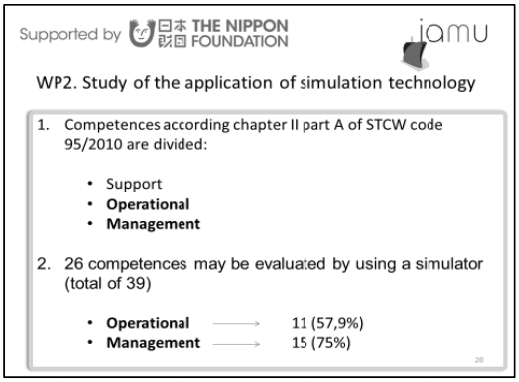
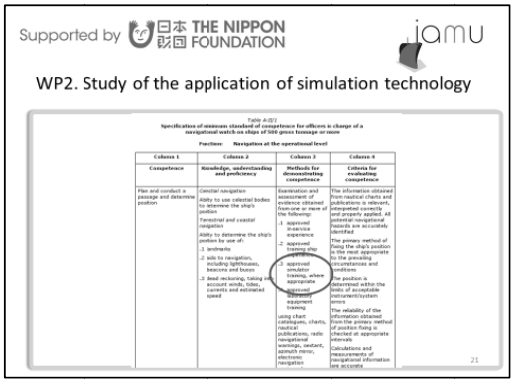
WP1. CONCLUSIONS

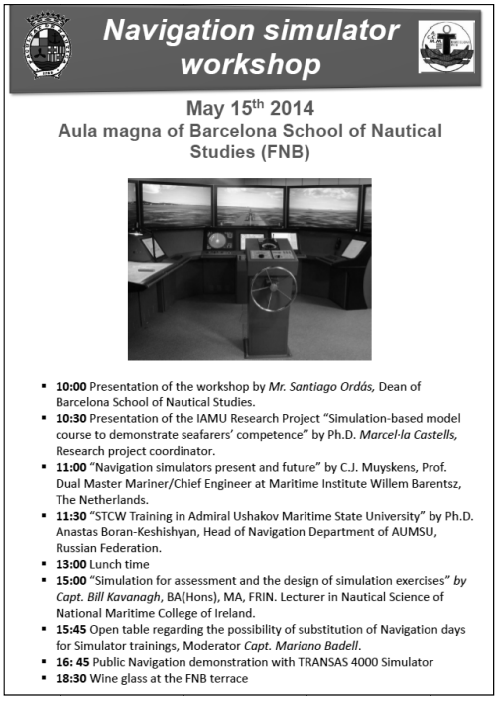
1. The majority of countries started implementation of CoC revalidation programs for training of marine officers using simulators.
2. Answers varies considerably from Country to Country.
3. Development of simulation model course for revalidation of CoC will help to expedite achieving of required education level
4. And equalize approaches of different countries in respect of revalidation programs.







2. Presentation of the research project at 19th CESMA (Confederation European of Ship Master Association) Annual General Assembly during the final meeting, 15th May 2014.



FURTHER ACTIVITES

1. Presentation of the research project at MT14, 6th International Conference on Maritime Transport, which will be held in Barcelona from 25 - 27 June 2014. More information at: (http://mtconference.upc.edu)

2. Presentation of the research project at International Navigation Simulator Lecturers' Conference (INSLC 18) at Massachusetts Maritime Academy, September 2014.

3. Presentation of the research project at AGA15, 15th Annual General Assembly of the IAMU, Launceston, Tasmania, Australia. 27-30 October 2014.

International Association of Maritime Universities

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