STCW-2010's New Rules and Effects to Maritime Education and Training

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Abstract In order to fulfill the requirements of the modern maritime industry; STCW Manila meeting which is held in May, 2010 brought new obligations to worldwide maritime education. The newly proposed changes in STCW contain a lot of new regulations rather than amendments. It is a serious issue how those new regulations will be applied to maritime education and what kind of methods will be followed for efficiency. Thus; in this paper the new regulations and amendments of STCW 2010 will be analyzed and the educational aspects that needs to be applied in maritime education so that the newly graduated students would be able to comply with the requirements without any need for additional certification courses.

Keyword: *STCW 2010, Maritime Education and Training*

1. Introduction

Due to the improvements in shipping industry and the accidents occurring on ships, several amendments in STCW (Standards for Training, Certification and Watchkeeping) Convention became almost inevitable. First signed in 1978 and became effective in 1984, The 1978 STCW Convention was the first to establish basic requirements on training, certification and watchkeeping for seafarers on an international level. It underwent extensive amendments in 1995 in order to resolve the problems for establishing an international standard [1]. Ambiguous expressions in the original version such as "satisfactory by the administration" were replaced by more solid and explicit regulations that can provide a basis for an international standard. Seafarers were divided into three levels; i.e. management level, operational level, support level, and proficiency of seafarers in each level were explicitly defined. For this purpose, training courses and contents were explained using detailed tables, especially for the officer level. An auditing system was established for the acts of each administration in both national and international level. Administrations of each member country were enforced to establish a "Quality Standards System" and training institutions of each level regarding training, certification and examination were obligated to be included in this system. According to this quality standards system, every institution has to establish a quality system, execute this quality system effectively, and improve it through "internal auditing".
Administrations must check the compliance of the training institutions to the systems via an "independent evaluation". Independent evaluation means an "evaluation by suitably qualified persons, independent and external to activity being evaluated, to verify that the operational procedures at all levels are managed, organized, undertaken and monitored internally". One of the most important amendments in STCW convention in 1995 is that international auditing mechanisms were formed. Administrations in each country are obligated to report the activities to IMO (International Maritime Organization) as an annual country report. On behalf of IMO, teams of "Competent Persons" who are

approved in MSC (Marine Safety Council) meetings evaluate the country reports to verify whether they fully and completely comply with the standards.
During the past 15 years, accumulation of acquired experience and emerging innovations has created a need for new rules and additional amendments in the convention. These amendments were discussed and approved in a diplomatic conference in Manila, 21 -25 June 2010 [2]. For this reason, any institution providing maritime education must adjust their courses and curriculum according to the new requirements. Thus, this paper aims to present the major amendments in STCW 2010 in an educational point of view.

2. Amendments of STCW Convention Done in 2010

In the convention, the following issues are discussed and determined:

1. Training and certification standards of newly introduced seafarers; i.e. able seafarer deck, able seafarer engine, electro-technical officer and seafarers.
2. Definition of ISPS Code Seafarer Security Representative, ECDIS, bridge and engine room resource management trainings under Code-A chapter.
3. Revision of deck and engine officer trainings in operational and management level according to modern technological requirements.
4. Promotion of awareness towards marine pollution
5. Definitions of leadership trainings.
6. Comprehensive revision of theoretical and practical trainings of engine officers.
7. Training requirements of alternative certification.
8. Definition of mandatory health requirements for seafarers, determination of working and resting times, prohibition of alcohol and drug use.
9. Precautions against illegal issuing and forgery of certification documents.
10. Enhancement of compliance of the administrations to the convention.
11. Training requirements of seafarers working in the polar zones, off-shore industry and those who work in ships with dynamic positioning system.
12. Basics of distant web-based education.
13. Updating training standards of seafarers working on tankers, definition of new training and certification requirements for those working on liquid gas tankers.

The most important amendments that concerns training institutions are listed in Chapter II, Chapter III, and Chapter V. Chapter II of the STCW and the associated sections of the STCW Code, are devoted to the requirements for the officers and ratings who serve in the deck department, and those who perform functions relating to navigation; cargo handling and stowage; controlling the operation of the ship and care for persons. Amendments in operational level are given in Table 1, whereas amendments in management level are given in Table 2.
When these amendments are examined, it can be easily noted that subjects related to ship and human management are shifted to lower levels; i.e. subjects related to Bridge Resource Management (BRM), leadership and management skills are now included in the operational level of seafarer training. Since VTS (Vessel Traffic System) has become an important tool for safe navigation and accident prevention by regulating and managing ship traffic, VTS training is also included in the seafarer training. Due to the 2010 amendments in STCW, a lot of subjects which were simple courses or certificate programmes in the past, are now considered as undergraduate courses
Chapter III of the STCW and the associated sections of the STCW Code, are devoted to the requirements for the officers and ratings who serve in the engine department, and those who perform functions relating to marine engineering; electrical, electronic and control engineering; maintenance and repair; and controlling the operation of the ship and care for persons on board. In this chapter several amendments were introduced not only on course contents but also on the duration of onboard training. The duration of onboard training is increased from. 6 months to 12 months. The amendment about onboard training is expresses as “have completed combined workshop skill training and an approved seagoing service of not less than 12 months as part of an approved training programme which includes onboard training which meets the requirements of section A-III/1 of the STCW Code and is documented in an approved training record book” in Regulation III/1, Rule 2.2. Besides the

increase in the duration of onboard training, a new concept called "workshop skill training" is also introduced. Thus, a new challenge is waiting for administrations and training institutions, since from now on just onboard training on ships is not enough and the candidates must also undergo a workshop skill training programme, whose location and duration must be determined and approved by the administration. Training in workshop skills ashore can be carried out in a training institution or an approved workshop.

The amendments in operational level are given in Table 3, whereas Tablo 4 summarizes the amendments in management level. As shown on these tables, important amendments are done related to engine-room resource management, application of leadership and team working skills, manage the operation of propulsion plant machinery, plan and schedule operations, manage operation of electrical and electronic control equipment, manage troubleshooting restoration of electrical and electronic control equipment to operating condition, use leadership and managerial skills. In addition to training related to marine diesel engines, marine steam turbine, marine gas turbine and marine boiler trainings should also be given in equal importance. Moreover, the content of subjects related to electrics and electronics must be increased in the educational curriculum.

Competence	**Knowledge, understanding and proficiency**
Maintain a safe navigational Watch	The use of information from navigational equipment for maintaining a safe navigational watch Knowledge of blind pilotage techniques The use of reporting in accordance with the General Principles for Ship Reporting Systems and with VTS procedures *Bridge Resource Management* 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
Use of ECDIS to maintain the safety of navigation	*Navigation using ECDIS* Knowledge of the capability and limitations of ECDIS operation including: .1 a thorough understanding of Electronic Navigational Chart (ENC) data, data accuracy, presentation rules, display options and other chart data formats .2 the dangers of over reliance .3 familiarity with the functions of ECDIS required by performance standards in force 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 .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 AIS and/or radar tracking) and radar overlay functions (when interfaced) .3 confirmation of vessel position by alternate means .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 .5 adjustment of settings and values to suit the present conditions .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

Table 1. Amendments in Table A-II/1

Competence	Knowledge, understanding and proficiency
Maintain the safety of Navigation through the use of ECDIS and associated navigation systems to assist command decision making	Management of operational procedures, system files and data, including: .1 manage procurement, licensing and updating of chart data and system software to conform to established procedures .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 logbook and track history functions for inspection of system functions, alarm settings and user responses Use ECDIS playback functionality for passage review, route planning and review of system functions Assessment of evidence obtained from one of the following: .1 approved in-service experience .2 approved training ship experience .3 approved ECDIS simulator training Operational procedures for using ECDIS are established, applied, and monitored Actions taken to minimize risk to safety of navigation
Use of leadership and managerial skill	Knowledge of shipboard personnel management and training A knowledge of related international maritime conventions and recommendations, and national legislation Ability to apply task and workload management including: .1 planning and coordination .2 personnel assignment .3 time and resource constraints .4 prioritization Knowledge and ability to apply effective resource management: .1 allocation, assignment, and prioritization of resources .2 effective communication on board and ashore .3 decisions reflect consideration of team experiences .4 assertiveness and leadership including motivation .5 obtaining and maintaining situational awareness Knowledge and ability to apply decision-making techniques: .1 allocation, assignment, and prioritization of resources .2 effective communication on board and ashore .3 decisions reflect consideration of team experiences .4 assertiveness and leadership including motivation .5 obtaining and maintaining situational awareness Knowledge and ability to apply decision-making techniques: .1 Situation and risk assessment .2 Identify and consider generated options .3 Selecting course of action .4 Evaluation of outcome effectiveness Development, implementation, and oversight of Standard operating procedures

Table 2. Amendments in Table A-II/2

Competence	Knowledge, understanding and proficiency
Maintain a safe engineering watch	*Engine-room resource management* Knowledge of engine-room 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
Use internal communication systems	Operation of all internal communication systems on board
Operate main and auxiliary machinery and associated control systems	Basic construction and operation principles of machinery systems including: .1 marine diesel engine .2 marine steam turbine .3 marine gas turbine .4 marine boiler .5 shafting installations including propeller .6 other auxiliaries including various pumps, air compressor, purifier, fresh water generator, heat exchanger, refrigeration, air conditioning and ventilation systems .7 Steering gear .8 automatic control systems .9 Fluid flow and characteristics of lubricating oil, fuel oil and cooling systems .10 deck machinery
Operate electrical, electronic and control systems	Basic configuration and operation principles of the following electrical, electronic and control equipment: .1 electrical equipment .a generator and distribution systems .b preparing, starting, paralleling and changing over generators .c electrical motors including starting methodologies .d high-voltage installations .e sequential control circuits and associated system devices .2 electronic equipment functions, .a characteristics of basic electronic circuit elements .b flowchart for automatic and control systems .c functions, characteristics and features of control systems for machinery items including main propulsion plant operation control and steam boiler automatic controls .3 control systems .a various automatic control methodologies and characteristics .b Proportional–Integral–Derivative (PID) control characteristics and associated system devices for process control

Table 3. Amendments in Table A-III/1

Competence	Knowledge, understanding and proficiency
Maintenance and repair of electrical and electronic Equipment	Safety requirements for working on shipboard electrical systems Safety requirements for working on shipboard electrical systems including safe isolation of electrical equipment required before personel are permitted to work on such equipment Maintenance and repair of electrical system equipment, switchboards, electric motors, generator and DC electrical systems and equipment Detection of electric malfunction, location of faults and measures to prevent damage Construction and operation of electrical test and measuring equipment Function and performance tests of the following equipment and their configuration: .1 monitoring systems .2 automatic control devices .3 protective devices The interpretation of electrical and simple electronic diagrams
Application of leadership and team working skills	Working knowledge of shipboard personel management and training A knowledge of related international maritime conventions and recommendations, and national legislation Ability to apply task and workload management including: .1 planning and coordination .2 personnel assignment .3 time and resource constraints .4 prioritization Knowledge and ability to apply effective resource management: .1 allocation, assignment, and prioritization of resources .2 effective communication on board and ashore .3 decisions reflect consideration of team experiences .4 assertiveness and leadership including motivation .5 obtaining and maintaining situational awareness Knowledge and ability to apply decision-making techniques: .1 allocation, assignment, and prioritization of resources .2 effective communication on board and ashore .3 decisions reflect consideration of team experiences .4 assertiveness and leadership including motivation .5 obtaining and maintaining situational awareness Knowledge and ability to apply decision-making techniques: .1 Situation and risk assessment .2 Identify and consider generated options .3 Selecting course of action .4 Evaluation of outcome effectiveness

Table 3. Amendments in Table A-III/1 (continued)

Competence	Knowledge, understanding and proficiency
Manage the operation of propulsion plant machinery	Design features, and operative mechanism of the following machinery and associated auxiliaries .1 marine diesel engine .2 marine steam turbine .3 marine gas turbine .4 marine steam boiler
Plan and schedule operations	Propulsive characteristics of diesel engines, steam and gas turbines including speed, output and fuel consumption Heat cycle, thermal efficiency and heat balance of the following .1 marine diesel engine .2 marine steam turbine .3 marine gas turbine .4 marine steam boiler
Manage operation of electrical and electronic control equipment	*Theoretical knowledge* Marine electro technology, electronics, power electronics, automatic control engineering and safety devices Design features and system configurations of automatic control equipment and safety devices for the followings : .1 main engine .2 generator and distribution system .3 steam boiler Design features and system configurations of operation control equipment for electrical motors Design features of high voltage installations Features of hydraulic and pneumatic control equipment
Manage troubleshooting restoration of electrical and electronic control equipment to operating condition	*Practical knowledge* Troubleshooting of electrical and electronic control equipment Function test of electrical, electronic control equipment and safety devices Troubleshooting of monitoring systems Software version control
Use leadership and managerial skills	Knowledge of shipboard personnel management and training A knowledge of related international maritime conventions and recommendations, and national legislation Ability to apply task and workload management including: .1 planning and coordination .2 personnel assignment .3 time and resource constraints .4 prioritization Knowledge and ability to apply effective resource management: .1 allocation, assignment, and prioritization of resources .2 effective communication on board and ashore .3 decisions reflect consideration of team experiences .4 assertiveness and leadership including motivation .5 obtaining and maintaining situational awareness Knowledge and ability to apply decision-making techniques: .1 allocation, assignment, and prioritization of resources .2 effective communication on board and ashore .3 decisions reflect consideration of team experiences .4 assertiveness and leadership including motivation .5 obtaining and maintaining situational awareness Knowledge and ability to apply decision-making techniques: .1 Situation and risk assessment .2 Identify and consider generated options .3 Selecting course of action .4 Evaluation of outcome effectiveness Development, implementation, and oversight of Standard operating procedures

Table 4. Amendments in Table A-III/2

Chapter V covers special training requirements for personnel on certain types of ships
Special requirements were introduced concerning the training and qualifications of personnel on board Ro-Ro passenger ships and on tankers. Most important amendments in this chapter are related to tanker trainings. According to the new amendments, tankers are considered under three distinct categories; i.e. oil tankers, chemical tankers and gas tankers. Moreover, separate tables are prepared for both basic training and advanced training of each tanker type, as given below.

- Table A-V/1-1-1 Specification of minimum standard of competence in basic training for oil and chemical tanker cargo operations,
- Table A-V/1-1-2 Specification of minimum standard of competence in advanced training for oil tanker cargo operations,
- Table A-V/1-1-3 Specification of minimum standard of competence in advanced training for chemical tanker cargo operations,
- Table A-V/1-2-1 Specification of minimum standard of competence in basic training for liquefied gas tanker cargo operations,
- Table A-V/1-2-2 Specification of minimum standard of competence in advanced training for liquefied gas tankers cargo operations.

3. Conclusion

The educational aspects of STCW 2010 discussed in this paper can be summarized as below;

1. Over the past years, subjects like management skills, leadership, human factors have been given to the trainees as certificate programmes. On the other hand, according to STCW 2010, these subjects are given in the operational level and are included in the curriculums of collages and universities.
2. In order to achieve navigational safety and accident prevention, it is aimed that awareness and consciousness of responsibility of seafarers should be enhanced.
3. Human-focused educational models have been increasingly maturated in the past few years. Thus human factor which has been generally neglected in the field of navigational safety, is becoming the center of safety concept.
4. It has been proven that the effect of perfect hardware and machinery on safe navigation is definitely not more than that of seafarers receiving adequate and qualitative training. Thus, human-centered changes must always be considered first.
5. When it comes to solving any problem on board, it is a general principle that an educational system that provides the seafarer with strong social and psychological state, teaches the seafarers to investigate, to produce alternative solutions is always preferred over that is entirely based on memorizing the existing subjects.

References

[1] IMO, “STCW’95”, London, (1995).
[2] Revised STCW Convention and Code adopted at the Manila Conference.