Particularities of the Maritime Higher Education System as Part of the Maritime Transport Engineering Studies

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Abstract: The higher education in the maritime field is a particular domain of the engineering education. The main characteristics are given by the existence of an international standard imposed by the International Maritime Organization (IMO) that is compulsory for all maritime universities combined with the national engineering curricula, that is also compulsory in accordance with the national standards. More than that, the maritime students must undertake a 6 to 12 month obligatory practical training on board ships. Starting from 2009, Constantza Maritime University has developed a project financed with European funds that aims for an increase in the quality of training and the practical skills of the students that will be working in the maritime industry, by organizing and undergoing on board training stages at higher standards. It is expected that once this objective is achieved, there will be a 40% increase in the chances of employment in the shipping companies for the Romanian students. A coherent, modern application of such a program with fully integrated on board training sessions, would ensure a better chance of employment for our students in the European fleet. If the "equality of chances" principle is considered, the increase of theoretical knowledge by acquiring specific practical skills for those students that undergo MARCON, for graduates of female gender an increase of up to 60% in their employment chances is expected as maritime officers on board maritime ships. The main purpose of our paper is to share with the academic community the findings related with the integration of this kind of practical training in the general engineering curricula.

Key words: maritime education, deck cadet, engineer cadet, maritime transport, MET, on board training, MARCON

1 Introduction

Today, Constanta Maritime University is the principal academic training institution in Romania. This position was acquired through a continuous effort to offer to the future deck and engine officers the best training and knowledge in the interest field. In this respect, changes were made, starting with revaluation of curricula, brought it more closely to the present requirements of the STCW Convention (Standard of Training, Certification and Watchkeeping Convention) and shipping industry, succeeded by the improvements of teaching methods, usage of the high technology and newest simulators in this process, and, finally, but not the last, improvement and increase the level of the trainers and teachers accordingly with the latest technological development in this area of training.

Education at Constantza Maritime University (CMU) aims two careers: one at sea as a merchant marine officer, to become a long distance Captain or a Chief Engineer; the other is an on-shore career in a nautical economic or nautical technical environment. The courses delivered at CMU meet stringent international and quality standard requirements set by the International Maritime Organization through IMO frame courses. Certificates from CMU are fully compliant with IMO STCW standards. Both in Nautical Sciences and Marine Engineering the STCW Operational Level is obtained at the completion of the Bachelor cycle.

The development of the maritime transportation and its connected activities imposed the necessity of having more trained people involved in this operation, able to act in very various situations based on a considerable volume of knowledge.

To achieve these standards, the training process, especially for operation, must be highly professional and in concordance with the international requirements in the field. This professional training involves the use of the latest developed techniques, as simulators, and dedicated computerized programs [11]. These new techniques and working procedures with a view to a better skills development represented, at beginning, a challenge for the traditional maritime academic training field, some of them still being a challenge due their continuous improvement and updates.

Once the shipping industry grew up the work force market requested more professionals and specialized persons, the training system, at all levels, but special at academic level, had to accept the challenge of necessary technology in order to respond and provide required personnel [2]. There is a worldwide shortage of more
than 35,000 merchant marine officers. According to the latest forecasts and market prospects during the coming years this shortage will continue to increase.

During the last decades, the seafaring profession in most western European countries has gone through a major change. It was registered an increase in the standard of living and diminishing salary differentials between jobs at sea and ashore in these countries. The required supply of ship officers can be guaranteed by Eastern Europe and Asia. Romania is an important supplier of officers, because the quality of the Romanian Maritime Education & Training (MET) system is worldwide recognized. Our graduates are trained for International companies, since a national fleet does not exist any more.

The attractiveness of a marine career in Romania is very high since their allowance is above internal standards. Romanian seafarers serve the International needs, but during their vacation they come back at their families and spend their incomes. These advantages are seen in the total number of students in 2009, enrolled in CMU:

<table>
<thead>
<tr>
<th>Academic level</th>
<th>Tuition paid by the government</th>
<th>Paid tuition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor of Science - full time</td>
<td>486</td>
<td>2388</td>
</tr>
<tr>
<td>Bachelor of Science - part time</td>
<td>-</td>
<td>2531</td>
</tr>
<tr>
<td>Master studies</td>
<td>203</td>
<td>363</td>
</tr>
<tr>
<td>Doctoral studies</td>
<td>19</td>
<td>14</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>708</strong></td>
<td><strong>5296</strong></td>
</tr>
</tbody>
</table>

Table 1 - Number of students in academic year 2009 - 2010

This was not an easy process, the beginning and first stages were complicated, partially due to the reduced knowledge on the new technologies and the better approach way to perform the best training in order to reach the proposed results. These difficulties were not finished once the familiarization started, they continued after this stage because the technological changes appeared soon with new products and also new procedures.

As we will see in the following pages, our main problem is to simultaneously comply simultaneously with two curricula standards:

1. the curricula standard imposed by the Romanian Ministry of Education for the engineering diploma;
2. the curricula standard imposed by the International Maritime Organization (IMO) for deck officers and maritime engineers certificate.

2 Role and application of the STCW Convention in the seafarer training

Despite its broad global acceptance, it was realized in the late eighties that the Convention did not achieve its purpose. Instead, the Convention gradually lost credibility as its widened acceptance. The main cause of this situation was the general lack of precision in its standards, the interpretation that was left to the satisfaction of the Administration. This resulted in a widely varying interpretation of its standards.

Since the development of the Convention in the seventies, many changes had taken place in the structure of the world merchant fleet and in the management and manning of ships.

During the 1995 revision process, no changes were proposed to the articles of the Convention so as to allow the amendments to be adopted and enter into force by means of the tacit acceptance procedure. This procedure can only be applied to the amendments made to the annex of the Convention.

Staying in the same subject area, at this moment, the training of the future maritime officers at Constanta Maritime University is made under the recommendations of the International Maritime Organization, according with the STCW Convention and IMO Model Courses for operational and managerial levels.

The STCW Convention provides the requirements necessary for a trained person involved in the operations on sea and the IMO Model Courses explain how can be satisfied these requirements and what areas have to be covered during the training process at the higher educational level for an operational or managerial

ISSN: 1792-426X

The responsibility of the maritime universities is to respect in their curricula the indications given by these documents and to do the training accordingly [12].

Taking into consideration the revision of the STCW Convention and Code was made long after its appearance, moment when basic concepts were considered outdated by the actual requests onboard the ships, the reappraisal of the IMO Model Course in order to cover present lacks especially for the use of the modern technologies in maritime activities is necessary.

There is an option to study electronic navigation separately, but much more usefully would be to combine with other navigational procedures, such as coastal and celestial navigation, in complex applications.

Also, requirements about the use of computerized techniques and specialized software for applications in the coastal and celestial navigation are necessary to be introduced in the mentioned courses model [9].

This conclusion comes from the actual situation on board ships, where the higher techniques are already present. The maritime university has the role to provide to the world fleet officers that are more trained and capable to work with latest equipment. It is unreasonable, in a century of high techniques, to teach about procedures in a field as navigation [15], but not to mention about the latest technology found onboard, made just to be used for a more safely navigation activity.

In order to improve competences and skills of the future officers, it is important to make changes on the present training requirements and bring them to the actual development of the maritime field and so, to consider the missing is covered [3].

Inside of this concept of uniform and updated training, Constanta Maritime University developed its profile and vision as maritime officers formative, combining STCW 95 Convention requirements with the latest technological development in order to provide to the international shipping market better trained people, capable to apply STCW objectives and also to use the modern technology for a more safety sea.

The improvement of the training process is compulsory in the present due to the new position of the Maritime Education and Training institutions, as providers of services for maritime industry and correspondent activities. In this respect, these institutions have to pay attention to the following underlying factors:

- programs and courses must meet industry standards and regular requirements;
- programs and courses must be relevant and meet clients and industry needs;
- training level of graduates must be accordingly with STCW and national authorities requirements;
- teachers and trainers involved in the training process must have a high level of knowledge and understanding of the system and its requirements under present in force regulations.

According with these major objectives, Constanta Maritime University developed its study programs under requirements of the Convention and applied the curricula recommended by the Convention through the IMO Model Courses for each of the principal specializations, Navigation and Marine Engine.

Not only the programs and curricula were developed and updated according with these requirements, also the study cycles were structured in the operational and managerial levels.

In order to achieve these objectives, Constanta Maritime University started a process of training the trainers, to improve and to update their knowledge and teaching skills to the present conditions and evolutions, based on:

- Development of the lecturers competencies through promotion of knowledge and technologies in the academic maritime field;
- Creation of a development, update and on-line management framework for initial and continuous formative of the human resources;
- Execution of studies and analyses in order to define formative programs and an optimum correlation of these ones with the maritime industry necessities;
- Increase of access and participation of the lecturers to formative programs in order to obtain a double qualification;
- Control of the process and teaching activities through initial and continue formative programs in scope of improvement of TIC using level.

All these are based on the premise than continuous learning is the main condition for reorganization and development of the educational and formative systems, for assurance of decisive competencies during life and to realize the coherency among persons involved in the maritime academic system.

Also, it is necessary to involve maritime lecturers in the international maritime transport framework, to put them in a direct contact with the end users of their work, the companies from the maritime industries and to know exactly their needs [1]. The international maritime companies are the necessary source of information regarding worldwide requests for employment of the maritime personnel.

Collaboration with partners from maritime field, as project objective, is founded on communication and information changes in order to identify and implement of adequate modalities to increase the number of work places and to optimize them [13].

According to the revised STCW Convention, the simulators must be used more effective in the training process of the future seamen and officers. The high
technology has to be used in order to increase the level of training and to reach higher standards of knowledge and skills.

The use of simulators and technology, especially electronic devices, in the training process offers the possibility to create models close to the reality. As a direct effect, the students are more implicated in the events and also more receptive to the training objectives.

In the first stage, we have to familiarize the students with all of these equipments and make them understand their function and role in the navigation, with implications in the safety of the maritime activities.

Today, many ships are armed with the latest technologies for navigation, as GPS devices, Anti-Collision Radar and Electronic Charts Display, Automatic Identification System devices.

During school training, future operators receive data about technical details, configuration, operational procedures, models of data analysis and correct decisions. During the applications made based on the simulators, the students have the possibility to develop their skills using these devices; they can work with them interconnected, analyze all data or compare data received from two different devices or from other sources. Thus, they will learn to use information in the navigation activities and at the end to realize a safe and correct travel for their virtual ship.

In order to achieve the STCW Convention requirements for onboard training, until 2004, Constanta Maritime University students' practice has been developed onboard of scholarship "Neptun", but due to a lot of engine and hull problems, this activity has been suspended.

After this practice, the solution found by Constanta Maritime University was to send its students in international voyages with different shipping companies, local or international, for this action being contacted the local crewing agencies or owners offices. This was the first step of the current situation, when over half of Constanta Maritime University students covers their requested onboard training on ships of different owners, most of them, international shipping companies with a great rename on the world shipping market, as NYK Ship Management, Japan, Peter Dohle from Germany, Maersk, Denmark, CMA-CGM from France and many others, in totally, 22 shipping companies being part of the partnership.

Taking into account the present regulations regarding onboard training period as cadet, 12 months for deck cadet and 6 months for engine cadets, our University took the decision to help and facilitate students' onboard practice. In this way, in the present agreements and protocols are signed between shipping companies, their local representatives and University, where are stipulated the requested training objectives, onboard live and work condition and schedule for students and the level of theoretical knowledge necessary to be acquired by students before to proceed to the onboard practice.

In time, the number of shipping companies interested to take cadets increased and the number of the trained students increased also. During the year of 2008, through this protocol, a number of 555 students covered their onboard practice on ship owned or under management of collaborative shipping companies.

3 Academic programs in CMU

Objectives and professional competencies for the three professional degrees (Bachelor, Master and Ph.D) were considered and curricula devised according to new concepts facing new realities, thus ensuring the students' and academics' mobility. Distribution of fundamental profile, specialty and complementary subjects was also revised.

To be promoted to managerial positions, B.Sc. graduates have to further education in master programs and even Ph.D. The university is supported by 22 crewing agencies within an Erasmus Program for European students to receive best training conditions on board international seagoing ships employing multicultural crews. Our undergraduates enrolled in the Erasmus mobility program benefit of best on board training conditions and also are granted consistent scholarships.

By rigorous analysis, the university was able to identify gaps in its educational offer. By adding training courses for employees of maritime industry and expertise for companies working in the field, CMU respond to the market demands in about 96%.

Maritime Education and Training (MET) evolves along with the fast development of maritime industry, since technological developments go hand in hand with efficient training.
Both theoretical education and practical training are demanded for professionals in order to meet requirements on practical abilities and to enhance the capability of fast responding to the various needs of the maritime industry. It is known that developed countries introduce advanced technology and modern ships, whereas developing countries produce the seafarers [5].

Maritime lecturers are facing two challenges:

• to develop a teaching syllabus able to meet expectations of the rapidly changing maritime industry in terms of both maritime business managers and deck officers;
• to handle with the number of hours allocated.

Steps followed for creating a maritime course curricula are depicted in figure 2:

![Diagram of course creation process](image)

Figure 2 – Drawing up a maritime course curricula

### 3.1 Defining the needs of graduates

Features of graduates are expressed by terms like knowledge, skills and attitudes.

These were defined by qualified representatives of teaching staff, representatives of the shipping and logistics industry, former graduates. The back bone of each maritime course lies on the competencies that must be gained by the student and mentioned as requirements in the STCW 95 Convention. We have to bear in mind that at graduation the students receive the B.Sc. diploma in transport or marine engineering. This engineering diploma is endorsed by the Romanian Ministry of Education and in accordance with the “Bologna” Convention the diploma is recognized in all EU countries.

In order to be certified as maritime officers they will undertake another exam organized by the Romanian Naval Authority. In order to accede to this exam, students must accomplish the compulsory on board training stage (12 month for deck cadets and 6 month for engineering cadets).

Consequently, we can say that the specific maritime competencies are mainly evaluated and certified by the Romanian Naval Authority, an institution that is not under the jurisdiction of the Romanian Ministry of Education. The maritime officer certificate issued by the Romanian Naval Authority is worldwide recognized, due to the STCW Convention provisions and the acknowledged quality standard of the Romanian MET system.

After defining the futures of the graduates, course topics have been developed in terms of "knowledge". This is the task of the professors in charge of the course and in case of courses with a great number of application hours the maritime instructors are also implicated in the planning process [10]. For the best identification of the students' professional training needs as future maritime officers, the academic staff involved in this activity must have a maritime background, usually as former maritime officers. For teachers without a maritime background but necessary involved in the professional maritime training of the students (i.e. Maritime English teachers), some familiarization with the maritime transport particularities is crucial [6]. For this purpose, CMU is organizing training courses, as the ones that are running in 2010 as part of the “MARCON” project. This project is financed by the EU and has as main objective to train the trainers that are teaching maritime related disciplines, mainly the young teachers and/or the teachers without a maritime background.

### 3.2 Hour allocation

Each topic allocated a number of hours according with the objectives of the two tracks in terms of "knowledge" and "skills". It is needed to take into account related disciplines and gained background. Lecturers of different disciplines have to cooperate in order to create non over dimensioned teaching syllabus. The number of hours of training for the disciplines directly related with the maritime profile is also defined at international level ant the Naval Authority is monitoring the correct number of ours for each course.

One of our main problems is related to the numbers of hours allotted for each year of study. In this specific time frame we have to include the general purpose engineering courses required by the Romanian Technical Education system and the maritime professional courses required by the STCW Convention. Our teaching curricula and courses syllabus are verified and certified at the same time by the Higher Education Quality Standards Commission of the Ministry of Education and by the Romanian Naval Authority.

Because in Romania we have only two maritime higher education universities, there are not many experts for the maritime education and training system working outside these universities. Consequently, each time we have to deal with an inspection of the Higher Education Quality Standards Commission we have to spend a lot of time explaining the particularities and specific requirements of the maritime education system, that are not common for the rest of the engineering specialization.

The number of hour allotted for the practical training is also a very big problem for our curricula. For deck
maritime students (cadets) there are no less than 12 month of compulsory on board training. For engineer cadets, there are 6 month compulsory period for the on board training. In order to accumulate 6 month (180 days) of training on board ships, you need an average period of at least 8-9 month, because you can not stay on board of a ship more than 3 to 4 month [7].

During the four years of study, only 6 month for the practical training can be covered by the academic curricula. This means that all students have to finish their on board training period after they graduate, before enrolling for the Officer of Watch Certification Exam [4].

3.3 Implementation of teaching syllabus
Created teaching syllabus is evaluated by the Head of Department and the Dean. They are interested in concepts like knowledge (definitions, laws, principles etc.), practice (to be used with basic equipments, to be able to use tables and charts, to collect and analyze data in laboratory) and professional skills (acquiring basic skills related with thermal machines). Also, Head of Department and the Dean check if the instructor supplies course notes and references. Teaching syllabus should also contain information on examination and calculation of grade. In order to meet the course requirements the instructor has to mention in the teaching syllabus number of independent learning hours.

All this information is contained in the “Guide of Student”, so that students are aware regarding course exigencies.

Students have to attend a well defined set of courses in order to complete their education process: lectures or practical training (using computers, laboratory equipments, simulators). Because the curriculum has to meet both standards for engineering and maritime training, 90% of the courses included in the curricula are compulsory.

More than that, there are a set of another eight professional courses (called IMO courses) that are included in the not-compulsory category. The paradox is that for the students that want to embraces the sea-going profession these courses are obligatory and have to be taken after the normal hour classes [8]. Without passing these courses, the students can not enrolled for the maritime officer’s certification exam organized by the Romanian Naval Authority.

Evaluation process refers to:
- students (accomplished by written, oral or practical examination);
- lecturer (students give feedback by filling in an assessment worksheet referring to clarity and precision of the explanation, voice, contact with students, time management etc.; these assessments contribute to the lecturer’s yearly evaluation);
- management level refer to monitor, control and maintain something related knowledge ensure operation, law/convention, maintenance, system, theory etc [14].

STCW’95 assures a minimum standard of competences. Taking into account the maritime industry present requirements imposed by the modern technology implemented on board ships, maritime officers need theoretical knowledge and strong experience at a higher standard that STCW 95. That is why our academic programs are covering much more topics and in deep presentations that the STCW 95 level.

We have also to underline that after a five year debate, in June 2010, the General Assembly of International Maritime Organization (IMO) will ratify the new version of the STCW Convention. There will be a lot of updates and upgrades of the provisions of the STCW convention, dictated by the last 10 years evolution of maritime transport.

In C.M.U. the knowledge layers are related with the academic programs as seen below:

<table>
<thead>
<tr>
<th>Knowledge layers</th>
<th>Academic programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>To find a new principle</td>
<td>Doctoral studies (Management level)</td>
</tr>
<tr>
<td>To apply the principle</td>
<td>Master studies (Management level)</td>
</tr>
<tr>
<td>To understand the principle</td>
<td>Undergraduate studies (Operational level)</td>
</tr>
<tr>
<td>To know the principle</td>
<td></td>
</tr>
</tbody>
</table>

Table 2 – Knowledge layers relation with academic programs

Teachers that are dealing with the training with our maritime students have to undertake from the beginning of their teaching carrier a set of courses for their own training. Most of the courses are delivered as part of a project (MARCON) financed by the European Union and cosponsored by the Romanian Ministry of Education and our university. Here we have the list of these courses:
- Bridge Team Management
- Marine Resources Management
- Train the Trainer
- Examination and Evaluation techniques for seafarers
- Nautical Institute Maritime Education Training Scheme:
  - Advanced concepts for design and delivery of E-learning courses”
  - New methods and technologies for research activities
  - Developments in the MET system and knowledge management
- Maritime English at World Maritime University
- Diploma in Ship Management la Lloyd’s
Academy
- Methodology for Analysis, Decision and Communication
- Instructor for Full Mission Ship Handling Simulator
- Instructor for Engine Room Simulator
- Instructor for Liquid Cargo Handling Simulator

4 Conclusions

Constanta Maritime University, as maritime training institution, respects and applies the complete requirements of the STCW Convention and national legislation regarding levels of training and content of the training process according with the final specialization, deck or engine officer.

Study programs are structured according with the requirements of the present regulations and with the shipping industry needs, at the end of the study years, the graduates having knowledge and skills necessary to perform their on board duties in respect of the safety and secure procedures and standards.

Since technological developments go hand in hand with efficient training, there is a necessity right now to enhance training that can keep pace with the accelerated high-tech advances.

For a MET academic institution it is very difficult to merge in only 4 years of studies all the theoretical knowledge needed for obtaining simultaneously a B.Sc. degree in engineering and a Certificate as maritime officer. More than that, the very long period of practical training needed for maritime officers (in accordance with the international maritime legislation) can not be accomplished during the undergraduate period of study.

Training the trainers that are teaching maritime related disciplines is essential for achieving the required quality standards and to transmit to the students the proper level of knowledge and skills required by the competencies that they have to achieve during the our year of academic studies.

The academic programs for future marine professionals in CMU respond to the recent needs of maritime industry, including master and Ph.D. studies.

We have to underline that in accordance with the last Romanian Naval Authority requirements, maritime officers must undertake a dedicated Master Course in Maritime Transport in order to accede to the managerial position on board ships (Chief, Officer, Chief Engineer and Master). This means that the overall time spent in university by a maritime officer is of 5½ years.

In order to comply with requests of partner shipping, crewing and manning companies, CMU is also dedicated to the Long Life Learning concept, offering different short time courses for the already certified.

References:


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