

SPECIFICITY OF TRAINING MARINE ELECTRO AUTOMATION OFFICERS AT THE FACULTY OF MECHANICAL ENGINEERING OF MARITIME UNIVERSITY OF SZCZECIN

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Abstract: Among the many seafaring profession Marine Electro Automation officer profession is still one of the most sought. Maritime universities are trying to adapt to the rapidly changing needs of the labor market. In response to the needs of shipowners electro automation profession was established at Maritime University of Szczecin. The article presents the specificity of training Marine Electro Automation officers at the Faculty of Mechanical Engineering of Maritime University of Szczecin. Rising requirements of graduates of this specialization and global rules on the education of students force universities to provide modern science base. The article describes the specialized laboratories, which are the main factor determining the quality of education.

Keywords: Marine Electro-Automation officer, quality of education, the STCW Convention.

Introduction

In comparison with ships constructed several decades ago, the current ships are fully automated. Crew's work have changed from watchkeeping to free of watchkeeping. Comprehensive automation of the ship is due installation on vessels complex, computerized control and monitoring systems.

The high degree of automation is determined by a team of technical characteristics of the implementation of control systems and monitoring. It takes into account of the properties: the man - machine control systems, control systems, systems of work due to the reliability and safety [1].

With the development of mechatronic on board Marine Electro Automation officers have

become the most sought employee by shipowners. This profession provides employment opportunities directly to the board, as well as in industrial land associated with maritime. Today, virtually every ship, regardless of the size and severity of ship operation systems, is impossible without Marine Electro Automation.

Electro Automation profession was established at the Faculty of Mechanical Engineering at Maritime University as a response to the growing demand of professionals in this field. A graduate receives a diploma of engineer, with a position which allows Marine Electro Automation officer to work on board of merchant fleet and take engineering work in companies on land. Graduates are now the best-paid specialists employed on regular Polish

ships and by foreign shipowners. For example, Polish Steamship Company - Poland's largest owner, continues to look for work in floating crews of Marine Electro Automation.

The effect of education in Marine Electro Automation field at Maritime University of Szczecin is to obtain knowledge and competencies consistent with the guidelines of the International STCW Convention. International Convention on Standards of Training, Certification and Watchkeeping STCW (International Convention on Standards of Training, Certification and Watchkeeping for Seafarers) [3], done at London on 7 July 1978, entered into force on 28 April 1984 and since that date in force in Poland (Dz. U. of 1984., No. 39, item. 201 and 202). Repeatedly corrected and eventually modified by the introduction in 1995 of two codes, it lists the minimum of knowledge and expertise, skills and the required certificates and powers necessary to perform the tasks at different positions of the ship. At the Conference of States Parties to the STCW Convention, which took place in 2010. In Manila, significant

amendments were added to the STCW Convention ("Manila amendments"). Convention amendments include requirements for seamen and create new professional profiles, among others, the profile of the profession of Marine Electro Automation officer. Maritime University of Szczecin is a member of the National Maritime Chamber, has been certified ISO9001: 2008 and as the first in the world is certified in compliance with requirements of the STCW [3, 4].

The specificity of the profession of Marine Electro Automation officer

The development of marine technology results in an increasing saturation of the various types of ships with electrical equipment. Full automation of ships, their computerization, makes greater demands as to the qualifications of the Marine Electro Automation officers supervising electric equipment, ships Professional duties of Marine Electro Automation officer (Fig. 1):



Fig. 1 Marine Electro Automation officer on the ship [9]

- carry out functions of head of the ship's electrical services in order to maintain a constant electrical technical readiness of the ship's gym, navigation lighting, emergency lighting and basic premises of ship, signaling the ship automation systems and electronic navigation equipment in accordance with the applicable international and national rules and instructions of the shipowner;
- organizes and carries out repairs of electrical equipment reported by heads of departments of ship;
- protects the technical condition and quantity of spare parts;
- participates in shunting, mooring and anchoring operations;
- prepares specifications of renovations and supervising their execution by shipyard workers;
- keeps in constant technical efficiency electrical, emergency systems;
- working with the appropriate technical services and employee;
- draw up a report on the technical condition of ship of electrical equipment;
- train crew in the field of health and safety and fire when handling electrical appliances ship.

Many years of practice (one of the authors) as the Marine Electro Automation may lead to the conclusion that this is a specific profession. Electro-automatic officer must have extensive knowledge of all electrical specialties (electrical machinery, electrical circuits and equipment, metrology, computer systems, energy systems, power electronics). It is important to know operation of the appliances and mechanical systems. The specificity of the profession is also connected with the fact that Marine Electro Automation is at work alone. Mechanics, for medium-sized ships, are three or four. They may consult with one another professional problems that need to be solved. Marine Electro Automation engineer must solve problems independently. Support service for reasons of cost is seldom used.

First cycle degree in Mechatronics has two specializations: Marine Electro Automation (EO) and Energy Systems Mechatronics (ESM). Students, after four years of study in addition to seagoing service pass the test at the University Examination Board (art.74 requirement of section 3 of the Law on Higher Education) and receive the diploma confirming competence for Marine Electro Automation officers. During the program, students pass

partial exams to confirm their knowledge and professional skills in accordance with the STCW Convention. The structure of the Mechatronics is shown in Fig.2.

Since 2010 with the development of the Mechatronics AM, the number of students choosing the EO profession have steadily increased.

In the academic year 2010/2011 the number of EO students in relation to the amount of students all over the ESM was 60% in 2011/2012 was 70%, and during the years 2012/2013 and 2013/2014 amounted to 100%. It follows that the students choose the profession Marine Electro Automation willingly. Histogram of Mechatronics is shown in Figure 3.

Didactic base for the profession Electro Automation

Specialized laboratories have the primary importance for modern didactic base. It is also important to prepare and teach the teaching staff. For example, in the Department of Electronics and Vessel Electronics at MU the majority of the teaching staff have many years of seagoing service experience in the position of Marine Electro Automation officers. This allows for the transfer of knowledge by combining the theoretical knowledge with practical knowledge.

Mechatronics at the Faculty of Mechanical Engineering of MU was created thanks to funding from the European Union under the European Social Fund project entitled "Development and promotion of technical directions of the Maritime University". Maritime University of Szczecin has received nearly 3 million zł for the implementation of this project. Modern laboratories for example of robotics and power electronics have been created [7, 8].

In the laboratory of electrical machines several laboratory stands have been built. An example would be a modern stand for testing cage of the asynchronous motor. The stand is equipped with two engine supply systems: three-phase autotransformer and energo-electronic inverter. An important element of the system is specially designed brake, which allows one to program different nature of the engine load, which is important in marine systems. The laboratory for testing cage asynchronous motor is shown in Figure 4.

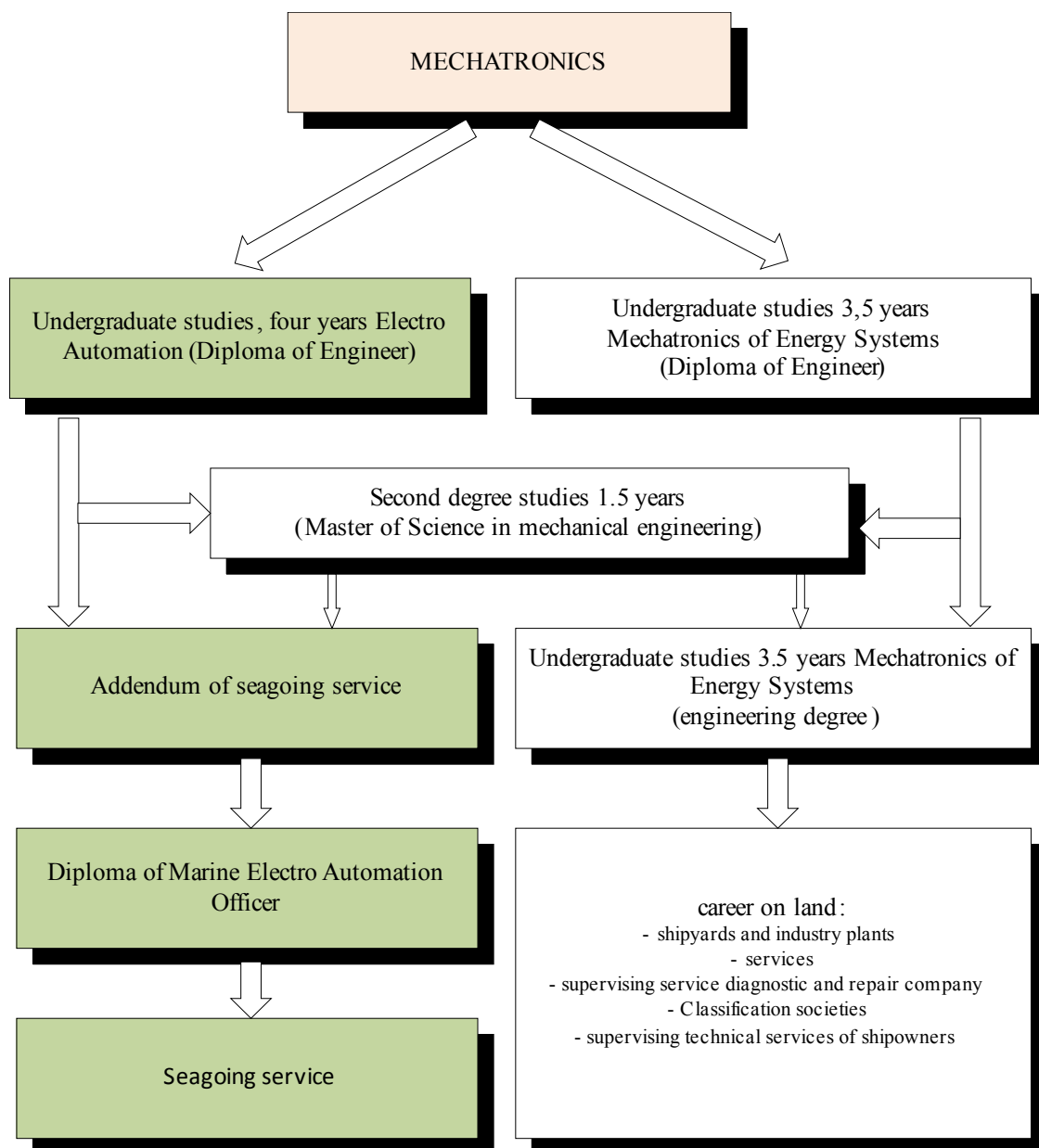


Fig. 2. The structure of the Mechatronics of the Faculty of Mechanical Engineering at the Maritime University of Szczecin

The project "Green Energy" [5] of the Maritime University built equipped laboratories with the latest technology, which students of electro-automatic field will be able to use in the near future. Currently it can be used within the scientific circles. Laboratory as proposed in the project is the first of this kind in Poland and one of the few in Europe. Within the project laboratory stands were created, which include:

- ring generator test stand;
- cage generator test stand;
- transformer test stand 0.4/15 kV;
- short-circuit breaker test stand SN;
- the test voltage and current transformers HV test stand;
- HV equipment and apparatus test stand;
- test stand of signal processing power equipment for statistical analysis of the results.

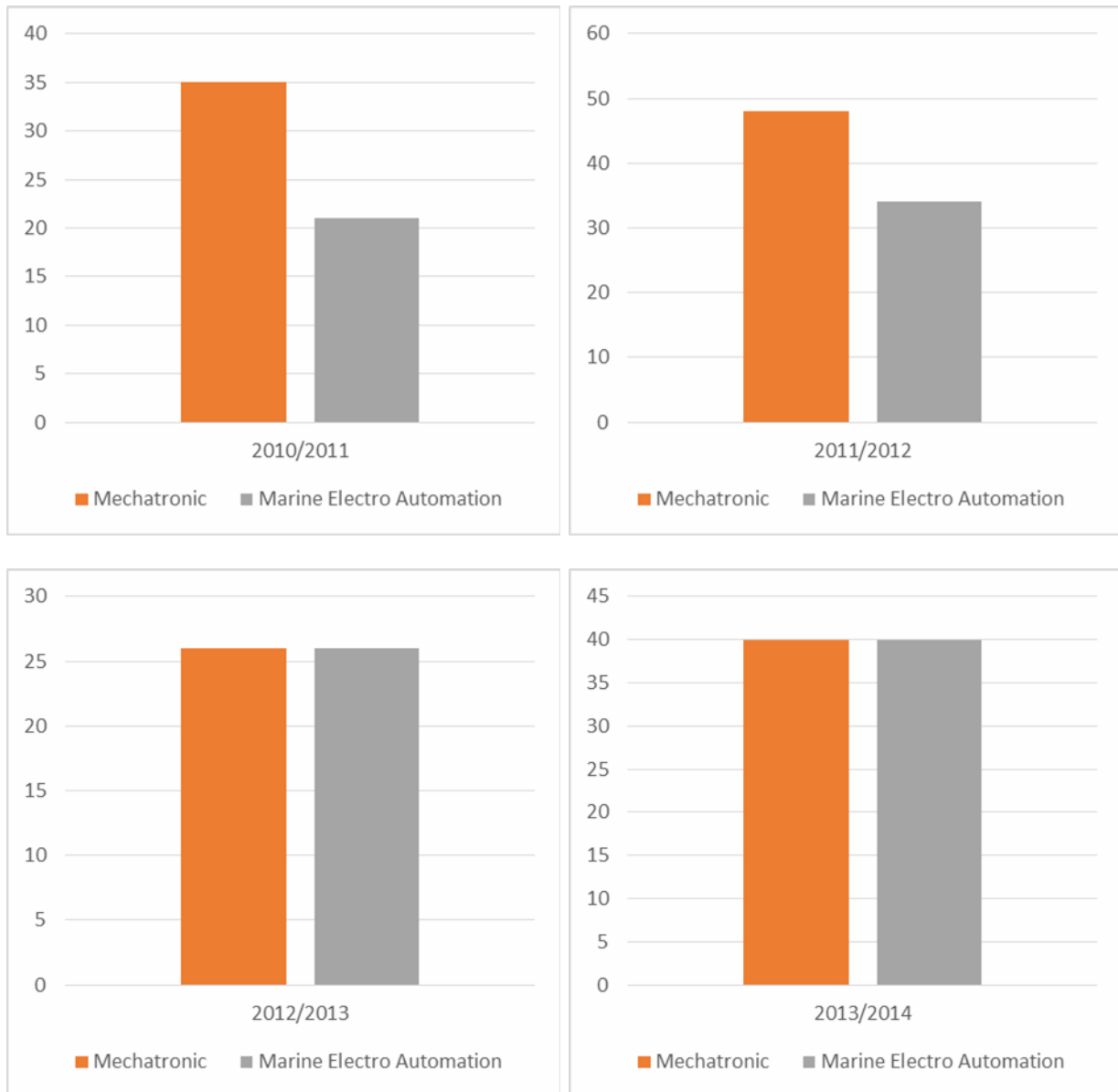


Fig. 3. Histogram of specialty Mechatronics

Figures 5 and 6 show the test stand to study different types of electricity generators (synchronous generator, the generator annular, generator cage). It is possible to examine the work of a single generator, parallel generator and synchronization of generators. This stand also allows to study the generator with varying

speed centrifugation, which is of particular importance in increasingly popular marine energy generation systems based on shaft generators. It is equipped with a lot of power electronic systems with the possibility of programming by using the programming logic FPGA.



Rys. 4. Laboratory stand for testing cage motor



Rys. 5. Stand of the study of different types of electricity generators

An important part of this position is the ability to test the quality of electricity from different sources, improving it through the use of active filters. It is also possible to test "Ship To Shore" (STS), which in recent years receives increasing popularity as the system of connecting ships with the power network on land when in port.

STCW Convention introduced requirements for Marine Electro Automation and Mechanics at the level of management and operational knowledge and expertise regarding the installation of high voltage (HV -High Voltage). Electro-automatics sailing on ships with the installation of high voltage HV should be certified. Understanding the HV is also

important because of the STS systems that are installed on ships where the main power system is a Low Voltage (Low Voltage). Within the project [5] the stand of TWN (High Voltage Technology) was established (Fig. 7).

Students on a laboratory stand can test TWN primarily HV apparatus and equipment, which are installed in marine systems.



Rys. 6. The laboratory of measuring of different generators



Rys. 7. The laboratory stand of HV (15 kV)

Conclusion

Marine electro- automatic teaching system at the Maritime Academy in Szczecin allows one to master the knowledge and competencies necessary to work in this specific profession. Teaching programs are based on the guidelines of the International STCW Convention and the Regulations under the Act on Maritime Safety, confirmed periodically by the relevant administrative authorities and certified with the Certificate of MU in the STCW.

Qualifications of the teaching staff and teaching base primarily based on modern laboratories allows implementations of objectives of curricula for the profession of electro-automation.

The increasing automation of marine systems and the specificity of the work of electro-automatic officers makes the profession sought on the labor market and the graduates of this profession find employment immediately.

References

1. Śmierzchalski R., *Automatyzacja systemu elektroenergetycznego statku*. Wyd. Gryf, Gdańsk 2004, ISBN-83-921110-5-2.
2. *Plan studiów i program nauczania dla kierunku Mechatronika na specjalności Elektroautomatyka okrętowa (EO) studia stacjonarne I stopnia*. Maszynopis, Akademia Morska, Szczecin 2011.
3. *International Convention on Standards of Training, Certification and Watchkeeping for Seafarers*, London, 7 July 1978.
4. *Akt końcowy Konferencji Stron Międzynarodowej Konwencji o wymaganiach w zakresie wyszkolenia marynarzy, wydawania świadectw i pełnienia wacht (STCW) z 1978 r.*, Philippine International Convention Centre w Manili, 21-25.06.2010.
5. *ZIELONA ENERGETYKA - Rozwój bazy B+R dla energetyki wiatrowej na Akademii Morskiej w Szczecinie* (<http://www.zielonaenergetyka.eu/> accessed on 19.02.2015).
6. Matuszak Z., *Charakterystyka kształcenia oficera mechanika okrętowego w Akademii Morskiej w Szczecinie w czasie postępującej globalizacji*. *General and Professional Education*, 1/2012, pp. 29-35 ISSN 2084-1469.
7. *Wniosek o dofinansowanie projektu PROGRAM OPERACYJNY KAPITAŁ LUDZKI. Rozwój i promocja kierunków technicznych w Akademii Morskiej w Szczecinie*. Maszynopis, Akademia Morska, Szczecin 2009.
8. Difort-Dura A., Matuszak Z., *Mechatronika – nowy kierunek nauczania na Akademii Morskiej w Szczecinie*. *General and Professional Education*, 1/2010, pp. 36-41.
9. <http://www.cruiseshipjob.com>, accessed on 19.02.2015.