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Training and Certification of the Marine Radio Operators in Poland

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ABSTRACT: The article presents a current status of the marine radio operators certificates required by the Radio Regulations of the International Telecommunications Union (ITU) and the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW Convention) of the International Maritime Organization (IMO). Analysis of the international requirements for the radio operators certificates was carried out. The process of obtaining certificates for radio operators and statistics of selected data of this process in Poland have been presented. It also describes a training for radio operators at the Gdynia Maritime University (GMU). At the end of the article a future of marine radio operator certification requirements have been discussed.

1 INTRODUCTION

In March 1899, the lightship East Goodwin, anchored off Dover, reported by radio that the steamer Elba had run aground. This event is considered to be the first radio distress signal. In 1906, at the second Radiotelegraph Conference, a signal SOS was adopted as a distress signal. Despite an adoption of this signal, the previously used Morse telegraphy distress signal CQD was still used to call for help for many years. The most famous use of the CQD and SOS signals was during the disaster of the RMS Titanic in 1912. The Titanic's radio operators initially transmitted the old distress signal CQD, and only later transmitted the SOS signal. After analyzing the disaster of the RMS Titanic, a special conference in London in 1913 established new regulations on safety measures and life-saving devices, which were included in the International Convention for the Safety of Life at Sea (SOLAS Convention), adopted in 1914. In a field of radio communications, the Convention introduced, among other things, an obligation to maintain 24-hour listening for the SOS distress signal when a ship is at sea on the frequency of 500 kHz, and during the so-called radio silence periods (between 15-18 and 45-48 minutes of each hour), ships were required to completely stop transmission and to exercise special listening. In addition, attention was drawn to the regulatory and unambiguous conduct of radio operators in distress situations, which should be ensured by their appropriate training.

In subsequent years, a number of new communication techniques were introduced to the maritime radio communications, including radiotelephony, digital transmissions and satellite communication. This required a change in the principles and procedures for conducting the radio communication, which was included in a training programs for radio operators. The largest change in this area was caused by the implementation of the Global Maritime Distress and Safety System (GMDSS system) in 1999. Taking into account the very wide scope of changes related to the introduction of the GMDSS system, both in terms of ship radio equipment and the principles, procedures and organization of conducting communication, it was decided to change

the requirements, as well as change the names of radio operator certificates. This, of course, resulted in a change in the training programs and the examination rules for people applying for the operator certificates in the GMDSS.

The requirements and types of the radio operator certificates are specified in the Radio Regulations (RR), which is a document supplementing the Constitution and Convention of the International Telecommunication Union (ITU). According to the Radio Regulations, in relation to ships subject to the SOLAS Convention, there are four categories of the GMDSS certificates [1]: First-class radio electronic certificate, Second-class radio electronic certificate, General operator's certificate (GOC) and Restricted operator's certificate (ROC). Of the above, the first two are dedicated to persons responsible for maintaining the operational readiness of ship electronic and computer equipment and systems, while the GOC and ROC certificates are for persons responsible for conducting the radio communications with shore and other ships. In relation to ships not subject to the SOLAS Convention (non-SOLAS ships), there are two categories of the GMDSS certificates: Long-range certificate (LRC) and Short-range certificate (SRC). There are also other radio operator certificates, supplementing those listed in the Radio Regulations, i.e.: Coastal station operator certificate (CSO), Radiotelephone operator's certificate in the inland waterways service (IWC) and VHF radiotelephone operator's certificate (VHF).

The above-mentioned the radio operator certificates used in maritime communications are implemented by the administrations of individual countries on the basis of the provisions of the ITU Radio Regulations and additional regulations of the International Maritime Organization (IMO) and, for European countries, also the regulations of the European Conference of Postal and Telecommunications Administrations (CEPT).

The authors of the article are members of the Polish examination board for the radio operators in the maritime and inland radiocommunication service.

2 CURRENT INTERNATIONAL STATUS OF THE MARINE RADIO OPERATORS CERTIFICATES

At the international level, the types and requirements for the marine radio operator certificates are specified in the Radio Regulations of the International Telecommunication Union - ITU and the relevant, additional regulations of the International Maritime Organization - IMO, contained in the SOLAS Convention, as well as in the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW). The above regulations are supplemented by the requirements in the relevant recommendations of both ITU and IMO and appropriate the IMO model courses.

2.1 *ITU Provisions*

According to Radio Regulations the service of every ship earth station and ship station using the frequencies and techniques for GMDSS, shall be controlled by an operator holding a certificate issued or recognized by the government to which the station is subject [1].

Each administration shall take the necessary steps to prevent, to the maximum extent possible, the fraudulent use of certificates. For this purpose, such certificates shall bear the holder's signature and shall be authenticated by the issuing administration. In the maritime mobile service for the GMDSS additionally shall bear the photograph of the holder and the holder's date of birth.

To facilitate the verification of certificates, these may carry, if necessary, in addition to the text in the national language, a translation of this text in a working language of the ITU, usually English.

All GMDSS certificates shall carry at least the following information [1]:
- the name and date of birth of the holder,
- the title of the certificate and its date of issue,
- if applicable, the number and period of validity of the certificate, and
- the issuing administration.

Each administration shall take the necessary steps to place the operators under the obligation to preserve the secrecy of correspondence.

According to Radio Regulations, as mentioned earlier, there are two categories of GMDSS certificates in relation to ships subject to the SOLAS Convention (the cargo ships of 300 gross tonnage and upwards) for the personnel of ship stations and ship earth stations responsible for conducting communications, this is [1]:
- General operator's certificate (GOC), and
- Restricted operator's certificate (ROC).

In relation to non-SOLAS ships (the yachts, motor boats or fishing boats), there are also two categories of the GMDSS certificates, this is [1]:
- Long-range certificate (LRC), and
- Short-range certificate (SRC).

There are also other the marine radio operator certificates, not listed literally in the Radio Regulations, but resulting from its general provisions and other regulations, this is:
- Coastal station operator certificate (CSO),
- Radiotelephone operator's certificate in the inland waterways service (IWC), and
- VHF radiotelephone operator's certificate (VHF).

The Radio Regulations requirements for the SOLAS GMDSS certificates, for which candidates must show proof of technical and professional knowledge and qualification, are shown in Table 1 [1].

It should be noted that a restricted operator's certificate (ROC) covers only the operation of GMDSS equipment required for GMDSS sea areas A1, and does not cover the operation of GMDSS A2/A3/A4 equipment fitted on a ship over and above the basic A1 requirements, even if the ship is in a sea area A1. GMDSS sea areas A1, A2, A3 and A4 are identified in the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended [2].

The requirements for the non-SOLAS GMDSS certificates (LRC and SRC), for which candidates must show proof of technical and professional knowledge and qualification are contained in ITU Resolution 343 (Rev. WRC 12) - Maritime certification for personnel of

ship stations and ship earth stations for which a radio installation is not compulsory. The personnel of ship stations and ship earth stations for which a radio installation is not compulsory either under international agreements or national regulations and which use the frequencies and techniques of the GMDSS shall be adequately qualified and certificated in accordance with the administration's requirements. Guidance concerning appropriate qualifications and certification is provided in mentioned earlier ITU Resolution 343 (Rev. WRC 12).

Table 1. Requirements for SOLAS GMDSS operator's certificates [1]

The relevant certificate is issued to a candidate who has given proof of the technical and professional knowledge and qualifications enumerated below, as indicated by X in the appropriate box	GOC	ROC
Detailed practical knowledge of the operation of all the GMDSS sub-systems and equipment.	X	-
Practical knowledge of the operation of all the GMDSS sub-systems and equipment which is required while the ship is within the range of VHF coast stations.	-	X
Ability to send and to receive correctly by radiotelephony and telegraphy to and from ship earth stations.	X	-
Ability to send and to receive correctly by radiotelephony.	X	X
Detailed knowledge of the regulations applying to radiocommunications, knowledge of the documents relating to charges for radiocommunications and knowledge of those provisions of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended which relate to radio.	X	-
Knowledge of the regulations applying to radiotelephone communications and specifically of that part of those regulations relating to the safety of life.	-	X
Sufficient knowledge of one of the working languages of the Union. Candidates should be able to express themselves satisfactorily in that language, both orally and in writing.	X	-
An elementary knowledge of one of the working languages of the Union. Candidates should be able to express themselves satisfactorily in that language, both orally and in writing. Administrations may waive the above language requirements for holders of a restricted operator's certificate when the ship station is confined to a limited area specified by the administration concerned. In such cases the certificate shall be suitably endorsed.	-	X

It should be emphasised that each administration may establish additional conditions, in addition to those set out above, under which GMDSS certificates may be granted.

2.2 *IMO Provisions*

The IMO regulations regarding the radio operator's certificates are contained primarily in two conventions:
- the International Convention for the Safety of Life at Sea (SOLAS Convention), 1974, as amended, and
- the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW Convention), 1978.

The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety. The Chapter IV of the Convention (Radiocommunucation) incorporates the Global Maritime Distress and Safety System (GMDSS). According to this chapter all passenger ships and all cargo ships of 300 gross tonnage and upwards on international voyages are required to carry equipment designed to improve the chances of rescue following an accident. With regard to radio personnel, the Chapter IV establishes that every ship shall carry personnel qualified for distress, urgency and safety communications purposes to the satisfaction of the Administration. The personel shall be holders of the appropriate certificates specified in the Radio Regulations and one of the personel shall be designated as having primary responsibility for communications during distress incidents. And also that in passenger ships, at least one radio operator shall be assigned to perform only communications duties during distress incidents [1].

The STCW Convention, was adopted by the IMO in 1978. Since then, a lot of amendments thereto have been adopted. The 1991 amendments, relating to the Global Maritime Distress and Safety System (GMDSS) were adopted by resolution MSC.21(59) and entered into force on 1 December 1992. The 1995 STCW Conference adopted the Seafarers' Training, Certification and Watchkeeping Code (STCW Code). The STCW Code consist of:
1. Part A - contains mandatory provisions, and
2. Part B - contains recommended guidance which is intended to help Parties implement the Convention.

In accordance with the annex to the STCW Convention, 1978:
1. every person in charge of or performing radio duties on a ship required to participate in the GMDSS shall hold an appropriate certificate related to the GMDSS, issued or recognized by the Administration under the provisions of the Radio Regulations,
2. in addition, every candidate for certification of competency under this regulation for service on a ship, which is required by the SOLAS, 1974, as amended, to have a radio installation, shall:
   - be not less than 18 years of age, and
   - have completed approved education and training and meet the standard of competence specified in the STCW Code.

In STCW Code, both in part A and B, Chapter IV (Radiocommunication and radio operators) is, similar to the SOLAS Convention, devoted to radio personnel.

In addition to the Radio Regulations requirements, every candidate for certification of competency shall be required to demonstrate ability to undertake the tasks, duties and responsibilities specified in section A-IV/2 of the STCW Code, given in table 2 [3].

It is worth noting that the Model Courses developed by IMO are also useful in the proper preparation of training courses for GMDSS operators. In relation to the GOC and ROC operator certificates, these are respectively:
- Model Course 1.25 on General Operator's Certificate for the Global Maritime Distress and Safety System (GMDSS) [4], and
- Model Course 1.26 on Restricted Operator's Certificate for the Global Maritime Distress and Safety System (GMDSS) [5].

Table 2. Specification of minimum standard of competence for the GMDSS radio operators [3]

Competence	Knowledge, understanding and proficiency
Transmit and receive information using GMDSS subsystems and equipment and fulfilling the functional requirements of GMDSS	.1 search and rescue radiocommunications, including procedures in the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual .2 the means to prevent the transmission of false distress alerts and the procedures to mitigate the effects of such alerts .3 ship reporting systems .4 radio medical services .5 use of the International Code of Signals and the IMO Standard Marine Communication Phrases .6 the English language, both written and spoken, for the communication of information relevant to safety of life at sea. *Note: This requirement may be reduced in the case of the Restricted Radio Operator's Certificate*
Provide radio services in emergencies	The provision of radio services in emergencies such as: .1 abandon ship .2 fire on board ship .3 partial or full breakdown of radio installations. Preventive measures for the safety of ship and personel in connection with hazards related to radio equipment, including electrical and non-ionizing radiation hazards

It should be emphasized that it is not the intention these model course programmes to present the instructors with a rigid "teaching package" which they are expected to "follow blindly". 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. Therefore, these model courses should be used as a framework for the training centres in developing their respective education and training programmes. Because the educational systems and the cultural backgrounds of trainees in the maritime subjects vary considerably from throughout the world, the ROC and GOC model courses material has been designed to identify the basic entry requirements and the trainee target group for each course in the universally applicable terms, and to specify clearly the technical content and levels of knowledge and skill necessary to meet the intent of IMO and other related instruments [4, 5].

3 CERTIFICATION OF THE MARINE RADIO OPERATORS IN POLAND

According to Polish law, the President of the Office of Electronic Communications (OEC) is responsible for the certification of radio operator certificates [6].

3.1 *The process of obtaining the marine radio operators certificates*

The process of obtaining certificates for maritime radio operators in Poland is regulated by the Regulation of the Minister of Administration and Digitization on radio equipment operator certificates. This Regulation specifies [6]:

1. types and templates of radio equipment operator certificates,
2. scope of examination requirements,
3. scope, mode and periods of necessary training and practice,
4. deadline for submitting an application for the radio equipment operator certificate or its renewal,
5. the procedure for conducting examinations, including resit examinations,
6. the method of appointing the examination board,
7. the fees for conducting the examination and issuing the radio equipment operator certificate.

The above Regulation establishes the following types of radio equipment operator certificates in the maritime and inland radiocommunication service for the persons responsible for conducting communications:

1. General operator's certificate (GOC) – entitling to operation of the GMDSS devices on the all seagoing vessels and the performance of the function of a radio operator in coastal stations,
2. Restricted operator certificate (ROC) – entitling to operation of the GMDSS devices on the all seagoing vessels, in sea area A1,
3. Coastal station operator certificate (CSO) – entitling to perform the function of a radio equipment operator in the coastal stations and the maritime rescue coordination centers (MRCC),
4. Radiotelephone operator's certificate in the inland waterways service (IWC) – entitling to operation of the radiotelephone equipment and DSC in an inland radiocommunication service operating in the maritime VHF and UHF bands,
5. Long-range certificate (LRC)– entitling to operation of the radio equipment used in GMDSS on seagoing ships not subject to the provisions of the SOLAS Convention, operating in the all navigation areas,
6. Short-range certificate (SRC) – entitling to operation of the radio equipment using frequencies and techniques used in GMDSS on seagoing ships not subject to the provisions of the SOLAS Convention, in sea area A1, and
7. VHF radiotelephone operator's certificate (VHF) – entitling to operation of the radiotelephone devices operating in the VHF maritime range.

The templates for the certificates listed above are set out in Annex 2 to the Regulation.

Radio equipment operator certificates are issued for an indefinite period, except for the certificates listed in points 1) - 2), which are issued for a period of 5 years. After this period, these certificates are subject to renewal in the manner set out in the Regulation.

The scope of examination requirements and a necessary training for the persons applying for a radio equipment operator certificate in the maritime and inland radiocommunication service is specified in Annex 5 to the Regulation.

For the radio equipment operator certificates referred to in points 1) - 2) above can apply a person who has completed training at a training center in a scope corresponding to the examination requirements for a given type of certificate, specified in Annex 5 to the Regulation. The confirmation of completing the required training is a certificate of completion issued by the training center.

The renewal of the GOC and ROC operator certificate can apply a person who has submitted an application for the renewal of the certificate no later than within 12 months from the date of expiry of the certificate. The person applying for the renewal of the

above certificates shall attach to the application an extract from the seaman's book and a certificate issued by the ship's captain, confirming a work at sea and performing the functions of the operator responsible for radio communication in the event of the distress situations, appropriate for the given certificate, for at least 12 months within the period of 5 years before the expiry date of the certificate held. In the absence of such certificate, the person applying for the renewal of the certificate should pass an examination within the scope specified in Annex 5 to the Regulation.

Examinations of persons applying for a certificate of radio operator in the maritime and inland radiocommunication service are conducted by an examination board. The examination board, from among persons with appropriate knowledge and practical experience in the scope of the assessed competences, is appointed by the President of the Office of Electronic Communications (OEC). Currently, this examination board consists of OEC employees and persons working in the training centers, including the maritime universities. The examination is conducted by the examination team consisting of the chairman of the session and the members of the examination board, including the secretary of the session, appointed by the chairman of the examination board from among the members of a given board, in the number of 3 to 8 persons.

The schedule of sessions for the maritime and inland radiocommunication service for the next calendar year is set once a year by the President of the OEC and announced on the website of the OEC Public Information Bulletin by 31 December. In the special situations, the President of the OEC may set an additional session, specifying its date and place.

A person applying to take the exam shall submit an application to the President of the OEC for issuing a radio equipment operator certificate at least 14 days before the examination date indicated in the application. The application for issuing a certificate must be accompanied by [6]:

1. two recent photos,
2. a certificate of completion of training at a training center, if it is required to obtain a radio equipment operator certificate - no later than the day of taking the exam,
3. a certificate of completion of the required practice, if its completion is required, or an entry in the seaman's book confirming a work at sea with the performance of functions appropriate to the given certificate,
4. a copy of a valid certificate of fitness to work on a ship, in the case of certificates mentioned in points 1) - 2) above,
5. copies of proof of payment of fees for conducting the examination and issuing a radio equipment operator certificate.

A person applying for the renewal of a radio equipment operator certificate shall attach to the application a copy of the radio equipment operator certificate to which the application relates, a copy of the seaman's book for the period of validity of the certificate and a certificate confirming work at sea and performing the functions of an operator responsible for radio communication in the event of distress situations.

The exams are conducted in one stage on one day. The examination subjects and requirements for the examination location are specified in Annex 7 to the Regulation. In accordance with this Annex, the examination for the persons applying for the GOC certificate is conducted by checking knowledge and skills in the following examination subjects [6]:

1. principles of operation of the GMDSS system and its subsystems,
2. operation of the GMDSS equipment and systems,
3. regulations used in the maritime radiocommunication service, and
4. English language.

Whereas, the examination for the persons applying for the ROC certificate in the subjects [6]:

1. principles of operation of the GMDSS system and its subsystems used in the sea area A1,
2. operation of the GMDSS equipment and systems used in the sea area A1,
3. regulations used in the maritime radiocommunication service, and
4. English language.

The exam is conducted in Polish or English, in oral or written form and in the form of a practical test of skills in operating the radio devices on real devices or simulators. The exam in each examination subject consists of the 5 to 20 examination questions. For answering each examination question, the person taking the exam can get from 0 to 5 total points. Depending on the sum of points obtained in the exam, this person can get a grade in each examination subject:

1. positive - for obtaining at least 60% of the maximum number of points,
2. negative - for obtaining less than 60% of the maximum number of points.

The exam is considered passed if the candidate receives a positive grade in each of the exam subjects. After the exam, the candidate confirms that they have read the grades awarded with their own signature. A person who receives a negative grade in the exam in at least one exam subject is entitled to take a repeat exam once, but no later than within 12 months from the date of announcement of the exam result.

The session secretary prepares a report of the examination, including grades for individual examination subjects. The report is signed by members of the examination team and the session chairman. The signed report is immediately forwarded to the chairman of the examination board.

The above mentioned GMDSS certificates are issued by the President of the Office of Electronic Communications according to ITU Radio Regulations and the IMO STCW Convention, what is indicated on the certificates.

All information related to the process of obtaining the marine radio operators certificates in Poland can be found on the website of the Office of Electronic Communications (OEC).

In order to supervise the GMDSS certificates issued in Poland, the Office of Electronic Communications maintains a website containing a register of issued certificates. This website allows the relevant authorities and administrations to check the validity of certificates issued by the OEC and whether they are not fake. This

register is available on the website: https://confirmation.uke.gov.pl/en/certificates.

To obtain confirmation of the authenticity/validity of a given certificate, simply enter the following data:
– Type of certificate,
– Number,
– Date of issue,
– Valid till,
– Name,
– Given names, and
– Birth date.

If the certificate is real and valid, a PDF document confirming this is generated. If any of the above data is incorrect, the following message is generated: 'x Negative verification {"error"=>" No data"}'.

3.2 *Statistics of selected data on the certification of the marine radio operators*

In Poland, there are the 7 main maritime educational units that prepare the candidates for the state examinations for certificates of the radio operators in the maritime and inland radiocommunication service. The scope of training provided by these units varies. In numerical terms, the scope of courses conducted for the given types of certificates is as follows: GOC – 5 centers, ROC – 5 centers, CSO – 5 centers, LRC – 6 centers, SRC – 7 centers, VHF – 7 centers, IWC – 7 centers. In all these training centers, the examination sessions are conducted in accordance with the Annual Schedule of examination sessions approved by the President of the Office of Electronic Communications. In addition to the above training centers, examinations for non-SOLAS certificates are also conducted at the headquarters of the OEC in Warsaw and 11 Regional Branches of the OEC. A comparison of the number of training and examination centers by type of the radio operator certificates is presented in Figure 1.

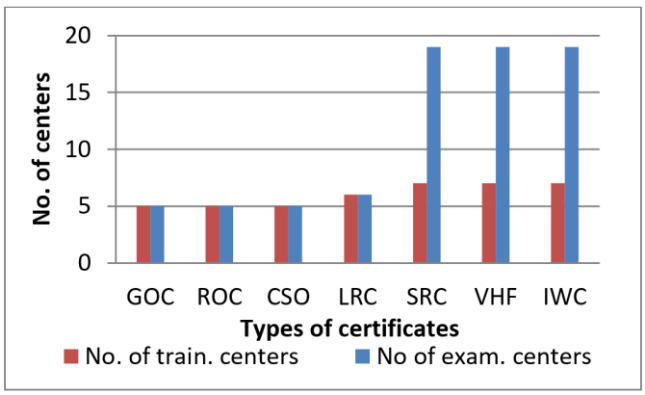

Figure 1. Training and examination centers for specific types of the radio operator certificates

In total, in the years 2015-2024, the Office of Electronic Communications issued 29,088 all types of certificates for the radio operators in the maritime and inland radiocommunication service. Figure 2 presents a comparison of the number of GOC and ROC certificates issued compared to the number of all certificates issued by the OEC in the years 2015-2024.

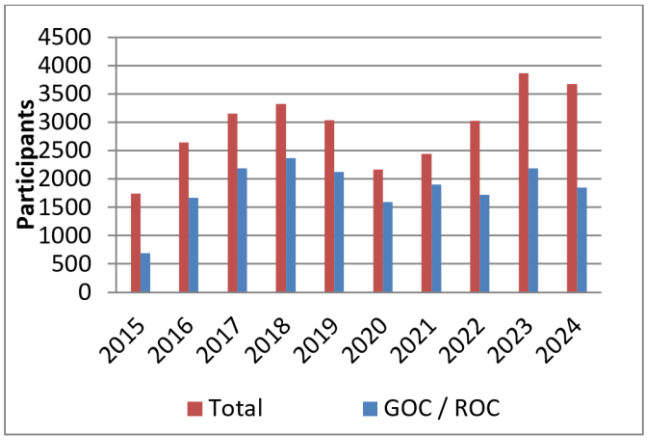

Figure 2. Summary of all issued GOC and ROC certificates compared to all issued certificates in 2015-2024

In Figure 3 is presented the number of GOC and ROC certificates issued by the OEC for the first time, the number of certificates issued after renewal with an examination and the number of certificates issued after renewal without an examination in the years 2015-2024.

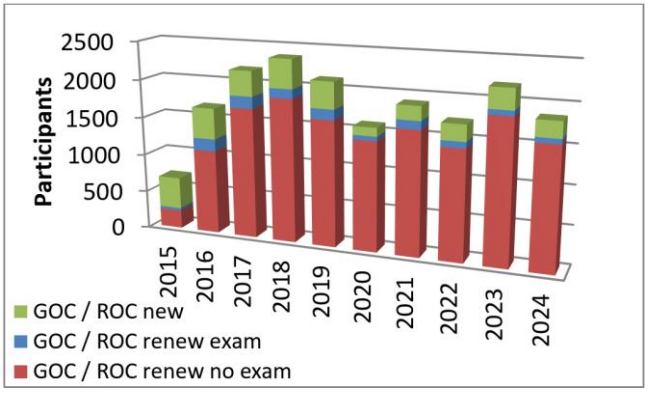

Figure 3. Number of GOC and ROC certificates issued, including the method of their issuance in 2015-2024

The next Figure 4 presents a summary of the number of non-SOLAS certificates (VHF, SRC and LRC) issued by OEC in the years 2015-2024.

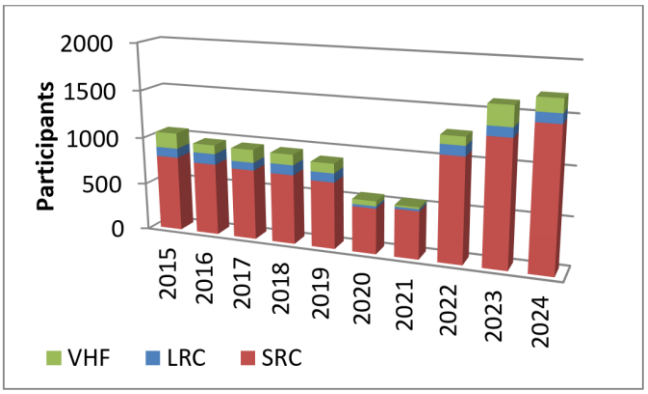

Figure 4. Number of the VHF, SRC, LRC certificates issued by OEC in 2015-2024

The following Figure 5 presents a summary of the number of CSO and IWC certificates issued by the Office of Electronic Communications in the years 2015-2024.

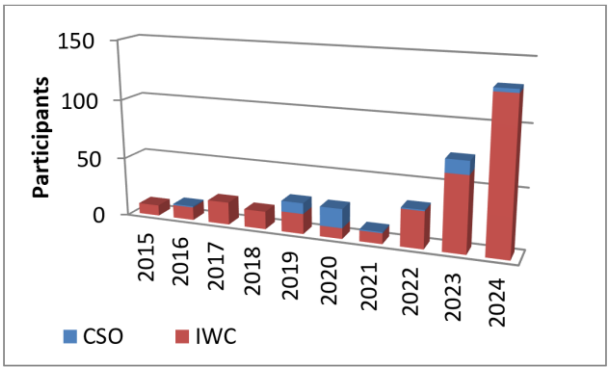

Figure 5. Number of CSO and IWC certificates issued by OEC in 2015-2024

The given above statistical data on the maritime radio operator certificates issued in Poland were obtained thanks to the Regional Branch of the OEC in Gdynia.

4 TRAINING FOR RADIO OPERATORS AT GMU

One of the most important training centers for the radio operator certificates in Poland is the Training and Education Center (TEC) of the Gdynia Maritime University (GMU).

4.1 *Presentation of the profile of the GMU TEC*

The Training and Education Centre is located within the walls of the Navigation Department of the GMU. It was established to provide specialized training for the all students of the GMU, who are educated according to the requirements of the STCW Convention, including all courses related to the maritime radiocommunication and the GMDSS system. The Centre organizes the courses for the external listeners and for students of the maritime faculties, preparing for the state examinations for all types of the radio operator certificates in the maritime radiocommunication and inland service, in accordance with international and national regulations. The training offer of the Centre also includes training for people renewing GOC and ROC certificates (so-called refreshment) and a dedicated training in the field of maritime radiocommunication.

The Training and Education Center has a modern technical base for conducting training both in the simulation laboratory and on real equipment (see Chapter 4.2). The TEC also organizes the state examinations of the commission appointed by the President of the Office of Electronic Communications.

4.2 *Training base*

The TEC training base is equipped with modern computer equipment and simulation software Wärtsilä GMDSS Simulator TGS 5000. This simulator enables training on various ship radio stations, including SAILOR 2000, 4000, 6000, and Furuno. The GMDSS Laboratory responds to the needs of trainees in terms of exploring the latest maritime technological and the system solutions with a high level of immersive experience (touch matrices, separated rooms for operating a virtual radio console or real devices), accurately imitating real ship-to-ship and ship-to-shore communications for all types of terrestrial and satellite communications used in GMDSS. The instructor can easily introduce various types of the interference on the selected frequencies, run and control previously prepared scenarios, performing the functions of a telephone subscriber, shore station operator and RCC operator (Figure 6). The simulator also allows for training in the field of the radio wave propagation using the built-in radio channel model. For self-training purposes, trainees can use the simulator in demonstration, test and examination modes. Figure 6 shows a view of the instructor's station and one of the training stations for the training participant, which is a separate section of the laboratory.

Figure 6. Instructor and training station with a simulated ship radio console

In Figure 7 is shown a view of one of the seven available training stations, suitably soundproofed with the acoustic panels, where simulation software for conducting communications using a satellite terminal was launched.

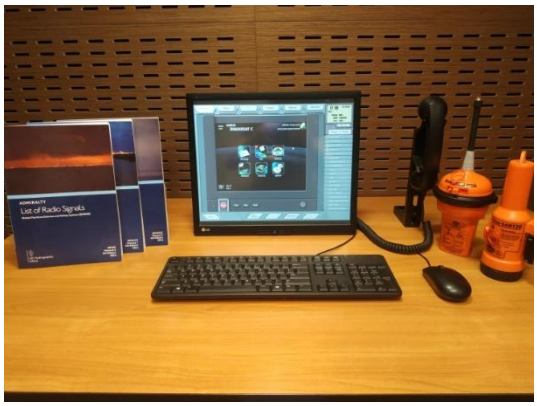

Figure 7. Training station prepared for satellite communication

4.3 *Statistical data of the TEC training courses*

This chapter presents selected statistical data on the training courses for the radio operator certificates conducted at the TEC in the years 2015-2024. In total, in the period under consideration, the GMU TEC trained 1,416 trainees for all types of the radio operator certificates in the maritime and inland radiocommunication service.

Figure 8 presents a comparison of the number of participants in GOC and ROC certificate courses compared to the number of all participants in all types

of certificate courses in the years 2015-2024. The comparison includes both participants in GOC and ROC certificate courses issued for the first time and those in the renewal of these certificates.

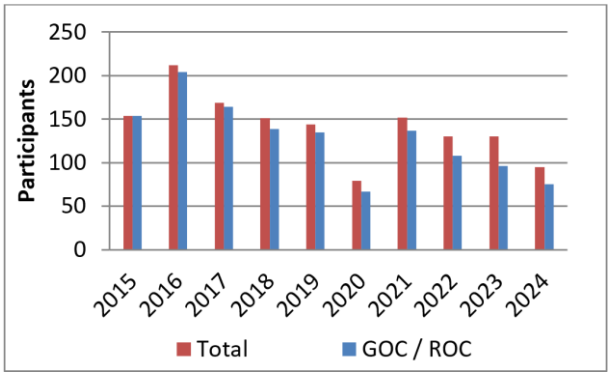

Figure 8. Summary of GOC and ROC certificate course participants compared to all trained participants in 2015-2024

The next Figure 9 shows a comparison of the number of participants in courses trained for GOC and ROC Certificates taking the exam for the first time with the number of participants in courses to renew their GOC and ROC certificates in the years 2015-2024.

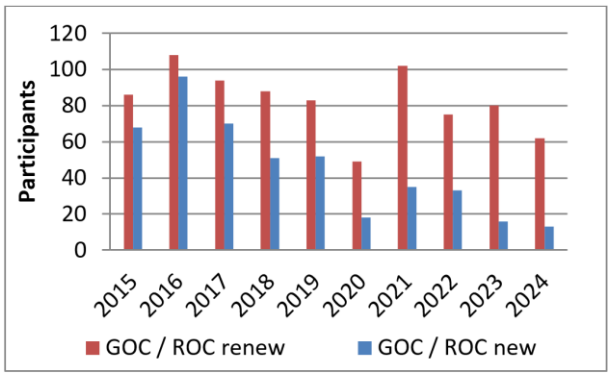

Figure 9. Number of participants in GOC and ROC certificate courses for the first time and those renewing GOC and ROC certificates in 2015-2024

The next Figure 10 presents a comparative summary of the number of participants in non-SOLAS certificate courses (VHF, SRC and LRC) in the years 2015-2024.

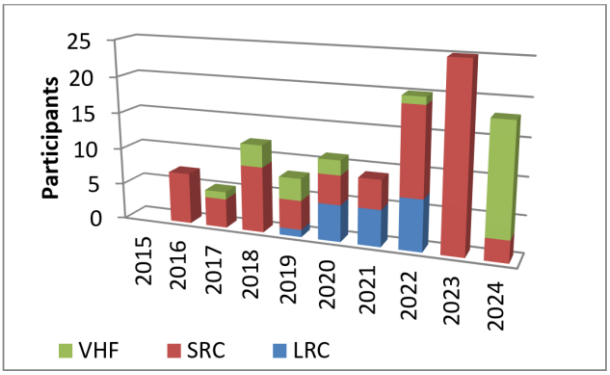

Figure 10. Number of participants in VHF, SRC, LRC certificate courses in 2015-2024

The last Figure 11 presents a comparison of the number of IWC certificate trainees trained by TEC and the number of CSO certificate trainees trained by TEC in the years 2015-2024.

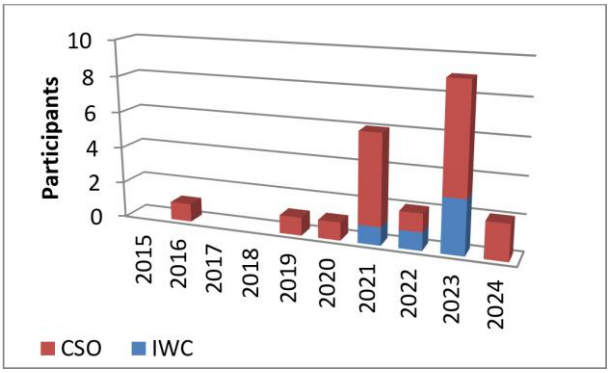

Figure 11. Number of participants in IWC and CSO certificate courses in 2015-2024

4.4 *Qualifications of the training staff*

The GMU TEC training staff consists of experienced employees with the necessary certificates. This creates comfortable, professional training conditions for the trainees and, above all, guarantees very good preparation for the exam. The training team currently consists of 6 instructors with extensive teaching experience, some of whom have many years of sea practice (Master Mariner, Second-Class Radio Electronic).

In terms of required training qualifications, the TEC instructors are trained in: Second-Class Radio Electronic Certificate, General Operator's Certificate, Certificate of Training in Didactics for Instructor (IMO Model Course 6.09), Certificate of Training in Didactics for Simulator Trainer and Assessor (IMO Model Course 6.10), and Certificate of Training for Examiner and Assessor (IMO Model Course 3.12).

5 THE FUTURE OF THE MARINE RADIO OPERATOR CERTIFICATES

Following the introduction of the GMDSS system in 1999, three important projects related to maritime radiocommunication were undertaken by the IMO, namely: the E-navigation" (2006) [8], the Modernization of the Global Maritime Distress and Safety System – GMDSS (2012) [7, 8, 9] and Maritime Autonomous Surface Ships – MASS (2019) [10].

In 2006, several countries submitted a proposal to the IMO Maritime Safety Committee (MSC) for preparing a broad strategy for the inclusion of new technologies in a comprehensive manner, to ensure their compatibility with the existing navigation and communication technologies and services. In response to this proposal, the MSC took the decision to initiate work on the E-navigation project [8]. Doubtlessly, one of the key elements of e-navigation will be a radio communication data transmission network based on new systems and those already used in maritime communications. The above led the IMO to undertaking work in 2012 on modernization of the GMDSS system used in maritime radio communications [7, 8]. After ten years of work, amendments to SOLAS Chapter IV concerning the modernization of the GMDSS system were adopted by MSC 105 in 2022, so that they entered into force on 1

January 2024 [9]. Of course, this also resulted in the change of many other related documents.

The implementation of e-navigation, even in relation to the defined Maritime Services in the context of e-navigation, will require the use of new, more efficient communication systems in addition to the existing GMDSS systems. Examples of such systems are the VHF data exchange system (VDES), both its terrestrial and satellite segments (VDE-SAT), or the NAVDAT system supporting the digitalization of maritime communications [8]. From the point of view of training marine radio operators, the above will certainly require appropriate changes in the training programs for the appropriate GMDSS certificates.

The modernization of the GMDSS system has brought a number of significant changes to the functioning of the GMDSS system and its subsystems or devices [9]. For example, the change in the definition of the sea area A3 and the change in the Functional requirements have resulted in changes to the Ship requirements, especially regarding Radio equipment [1]. These and other changes resulting from the modernization of the GMDSS system will not, however, require changes to the GMDSS operator certificates themselves, but of course they will require changes to the training programs for the appropriate certificates.

To sum up, it seems that the changes in the maritime radiocommunications caused by the results of work on the e-navigation and GMDSS modernization projects will not require the introduction of new GMDSS operator certificates, but only corrections and updates of the existing training programmes for these certificates.

In the case of implementing IMO's work on Maritime Autonomous Surface Ships (MASS), the situation will be completely different, because radio data transmission networks based on new communication systems appropriate for controlling autonomous ships will have to be used [10]. Therefore, a new area of training activity will certainly be the preparation of the maritime radio operators working on land to manage an autonomous fleet. As of today, there are no such certificates for radio operators, so it will require the preparation of new, appropriate training programs for these land operators.

6 CONCLUSIONS

As shown in the article, the training of the marine radio operators is the dynamic process, both in the terms of technological and regulatory changes and, not discussed in the article, the changes in the rules and the procedures for the maritime communications.

The training requirements for the marine radio operators contained in the ITU Radio Regulations and the IMO Conventions (SOLAS and STCW) are of a general nature. This is due to the fact that changing them is the time-consuming process. Changes to the regulations contained in the ITU Radio Regulations are possible only during the World Radiocommunication Conferences (WRCs) held every four years, and each proposal for a change must be submitted at least eight years in advance. Introducing changes to the SOLAS Convention and the IMO model courses is similarly time-consuming.

According to the authors, detailed changes/updates to training and the examination requirements for the marine radio operators should be introduced at the level of individual countries, through the national regulations. Of course, the national regulations/ changes should always take into account current, international requirements and the current results of work on the training requirements for the marine radio operators conducted within the ITU and the IMO.

The process of obtaining certificates for the marine radio operators in Poland presented in the article seems to be the right process, ensuring on the one hand its readability for those interested, and on the other hand ensuring the appropriate level of knowledge and the skills of people obtaining GMDSS certificates. However, it should be noted that the Polish Regulation of the Minister of Administration and Digitization regarding the radio equipment operator certificates was published ten years ago, in 2015, and it is somewhat out of date. As indicated earlier, these examination requirements should also be specified in more detail.

It should be emphasised that any introduction of a radio data transmission network based on the new systems into the maritime communications should also entail a change in the communication principles and procedures applied, which should be included in the training programmes for the GMDSS operators.

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