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Further Studies On The COLREGs (Collision Regulations)

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ABSTRACT: The collision risk is one of the major reasons threaten safety at sea. The Collision Regulations (COLREGs) is the essential international arrangement which regulates the rules of the roads at sea. Being also a legal document, the language of the COLREGs is not so apparent for the end users (navigators) and this causes some misunderstandings and ambiguity. Many discussions on COLREGs have continued since its first submission related to its application. It seems unlikely to make a radical change on COLREGs even on its manner of introduction. So it would be better to improve new methods to ensure the effective use of COLREGs in particular in the field of education and training. It is aimed to review the existing studies on COLREGs and recent improvements in the maritime education, and investigate applicable and reliable solutions to reduce the negative impacts experienced during the application of the COLREGs.

1 INTRODUCTION

The Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs) entered into force in 1977. Besides COLREGs, IMO also issued a series of resolutions and codes related implementation of COLREGs. Additionally, many institutions provide intensive and extensive training and education programmes for correct application of COLREGs.

A large number of accidents over the last few years, with 100s fatalities, like Piper Alfa, Herald Free Enterprise, Estonia and Scandinavian Star have drawn attention to human factor, the role of training, the role of the incident commander, decision making under stress and the culture/climate in maritime safety (Havold, 2013). The human factor is the most important element of the merchant shipping which directly affects the safety and security at sea. Although there are many factors endangering the safety at sea, the common assertion is that most accidents are emanated from poor training. Therefore, an effective Maritime Education and Training (MET) programme is an important requirement to improve seafarers' quality for the future. Seafaring is an international profession and that is the reason why International Maritime Organization (IMO) establishes common standards for seafarers' education and training.

The studies over the investigation reports of sea accidents prove that 60 % of accidents are due to human error, 19% structure/mechanical failure and 10% equipment failure (MAIB, 2007)(Figure 1). Although we do not have a reliable study on accidents directly related to the application of the COLREGs, we can assume that most of the human error related accidents are closely connected with the evasive maneuvers to avoid the collision which are insufficient to eliminate the risky situations. The structure/mechanical failure and equipment faults can

also contribute to the ambiguity on the bridge and could be main reasons of accidents with their special features to increase human error.

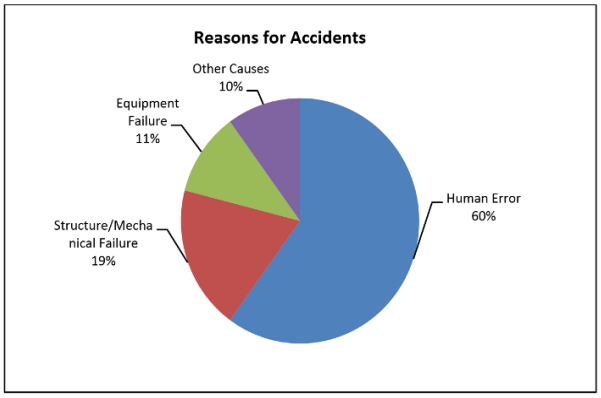

Figure 1. Reasons for Accidents (Source: Ziarati, 2011)

Therefore studying the role of the human errors in sea accidents is a must case to establish a model which will enable us to reduce the number of accidents eventually.

A study made in 2012 shows that the foremost causes of the ship losses are stranding, grounding, sinking or submerging (See Figure 2). All those causes somehow are related to the human factor. But the personnel or crew failures may not be the only ones to be blamed for human errors. An education or training method aimed to reach one essential purpose may be a multiplying factor contributing to all occurrences. The figure shows only 8 percent of the ship losses are related just for collisions. But we have no sufficient information on the numbers of the groundings, machinery or hull damages which are happened as a result of evading maneuvers recommended/ordered by the Collision Regulations.

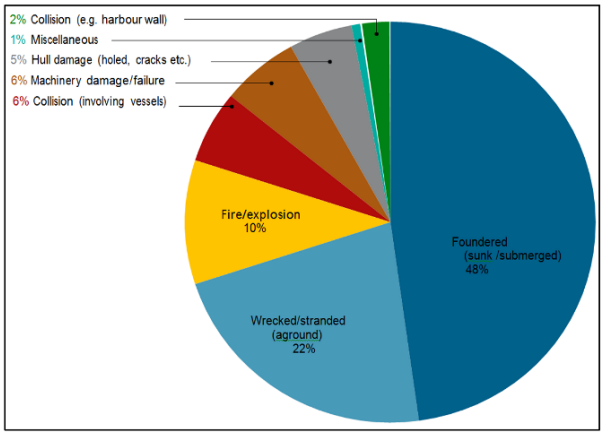

Figure 2. Causes for ship losses in 2012 (Source: Lloyd's List Intelligence Causality Statistics)

The statistical analysis shows that observed behaviour is not haphazard, even if it cannot be predicted from the formal rules (Chauvin, 2008). Accidental causes of agrounded and foundered ships could be depending on human factors mostly misapplication of different rules and regulations. This determination draws our attention on training to improve human behavior in case of emergency situations.

Currently, ships nowadays have a number of crew which is much more reduced than the number previously used on board since many functions are designated to the automation systems today. An Officer of the Watch (OOW) who is mostly alone is responsible from handling the ship along with many other responsibilities and taking all measures listed in the anti-collision check list solely. The OOW is expected to inform the master, the crew and other ships in the vicinity by all means of the communication and assess the situation in due regard with respect to COLREGs to start evasive actions in case of an emerging close-quarters situation. That means OOW should be trained perfectly on the "application of the COLREGs" to be able to give quick, correct and on-time response to developing collision risks. The critical success factor is the high level knowledge of the OOW on the applications of the collision regulations supported with a serial of practice opportunities based on different type of accident scenarios. Such a formative and holistic training must prepare the officers to respond appropriately to emergency situations and contribute to elimination of collision risks which may have fatal results for ship, human beings and environment.

The STCW (Standards for Training, Certification and Watchkeeping) Convention has moved from being knowledge-based to competence-based training and assessment, where clear outcome-based standards of competence have been established and the tasks and skills are defined in terms of outcomes to be achieved to meet today's industry demands. The knowledge, understanding and skills needed to ensure that seafarers are capable of fulfilling the roles expected from them on board have been clearly defined and tabulated. Consequently, this necessitated the detailed review and revision of all maritime education and training programmes to ensure the amendments were clearly reflected. Thus, direct and significant responsibility was placed on trainers and assessors for knowledge and skills acquisition and demonstration of competence by seafarers for safe operation of ships and, by default for maritime safety (Milhar, 2014).

IMO Model Courses are frameworks for maritime education providers to develop their trainings based on the IMO STCW, but they are not a list of concrete knowledge and skills. Even at this very moment, many model courses are under consideration of the IMO MSC HTW (Human Element, Training and Watchkeeping) Sub-Committee (IMO, 2014) and IMLA members who were encouraged to send proposals for education development studies (IMLA, 2014). A lot of creative ideas based on the best practices will be defined to develop better training methods for collision avoidance training for MET institutions which will also be discussed in this study.

2 METHODOLOGY

This study aims to review the literature on collision regulations and the recent improvements in the maritime education dealing with this subject, to investigate the negative impacts experienced during the application of the COLREGs and to bring about

some applicable and reliable solutions for more effective COLREGs trainings to be discussed in related maritime forums.

The study was carried out in three stages. The first stage was a literature review on maritime accidents involving the collision regulations. Evaluating the results of studies including reports and scientific researches on the subject and verifying the results of these studies were aimed in the literature review. Second, an overview of the existing teaching methods and recent improvements in the maritime education were discussed by a working group consisted of maritime lecturers to develop a new teaching method. Finally, applicable and reliable solutions were examined to reduce the negative impacts experienced during the application of the COLREGs to lead proposals.

3 DISCUSSION

3.1 *Collision Regulations (COLREGs) and Existing Studies*

The aim of the Collision Regulations (COLREGs) is to establish rules to avoid collision at sea. The increasing number of ships and condensed traffic on the sea lines of communication makes the COLREGs rather important for safety of the seas. The increasing number of the accidents with fatal results and unbearable damage to environment sets the attention of the maritime community on the applications and adequateness of this significant regulation.

The language introduced in the COLREGs is mostly based on the legal terminology and sometimes not so clear and understandable for seafarers. As being a legal document, it is not easy to change the introduction style of the COLREGs and any attempt to simplify the language long used may cause additional problems when a collision case appears in the legal courts. Although there have been many discussions about collision regulations and many scientific papers were written proposing some changes on the rules, no changes have been realized so far. These types of discussions are still on, but no change for the existing rules is expected in the foreseen future.

The commonly shared opinion is the COLREGs related accidents were not due to a lack of uniform interpretation of the rules but because of the insufficient training on application of the existing regulations. Nowadays the maritime community is focused on the better training models rather than modification of the rules in order to improve effective application of the COLREGs.

IMLA (International Maritime Lecturers Association) is the largest international platform for the discussions on the maritime education and training (MET) and provides a significant support to IMO for the improvement of education quality. IMLA is of the view that IMO has provided a clear COLREGs text; accordingly, relevant organizations have developed many interpretations of these regulations and used them in their teaching and training activities. IMO has responded positively to the emerging needs of improved training on COLREGs by developing new type of training models.

In IMLA Newsletter (IMLA, 2014), it was disclosed that the Maritime Safety Committee had reviewed and provided their positive comments on the development of a specific model course for the 1972 Convention on the International Regulations for Preventing Collisions at Sea (COLREGs) as proposed by the Turkish Maritime Community "to ensure global standards on the understanding, interpretation and application of the provisions of COLREGs".

Actually COLREGs are already included in Model Courses 7.01 and 7.03 which are the main advisory training programmes for Deck Officers. The discussions on these documents are not based on the requirements, guidance or content of the COLREGs training but the teaching method and procedures. What required now is to develop a new training method, guidelines and material to make learning and teaching of this subject easier and more effective. This new training method should improve the understanding of the rules by users and equip them with a better ability to apply the rules in emergency situations at sea.

3.2 *Avoidance Collision At the Sea (ACTs) Project*

Most recent study on the improvement of a COLREGs training is ACTs (Avoidance Collision at the Sea) Project supported by the European Commission. The project partners are working for developing an online training course to improve the COLREGs training and determine if new rules or changes to current ones are necessary (http://ecolregs.com/).

ACTs project group has completed a survey on the questions designed to determine which rules are difficult to understand and which rules are most often breached in real practice in addition to check the COLREGs knowledge of the participants from different countries and different target groups including amateur sailors from Bulgaria, Croatia, Slovenia, Turkey, United Kingdom and Spain.

Analysis of the questionnaire results in understanding the COLREGs rules shows that maritime education and training lecturers have best scores followed by seafarers with sea experience who have average 15% better scores than participants with no sea experience (See Figure 3).

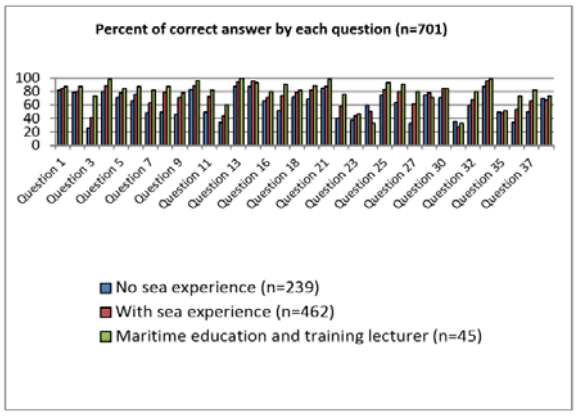

Figure 3. Percentage of the correct answer by each question

As for the questionnaire analysis results, some rules are difficult to understand for the participants. The rules considered hard to understand according to all participants are Rules 6 (Safe speed), Rule 8 (Action to avoid collision), Rule 9 (Narrow channel), Rule 10 (Traffic separation scheme), Rule 13 (Overtaking), Rule 18 (Responsibilities between vessels) and Rule 19 (Conduct of the vessels in restricted visibility) (Figure 4).

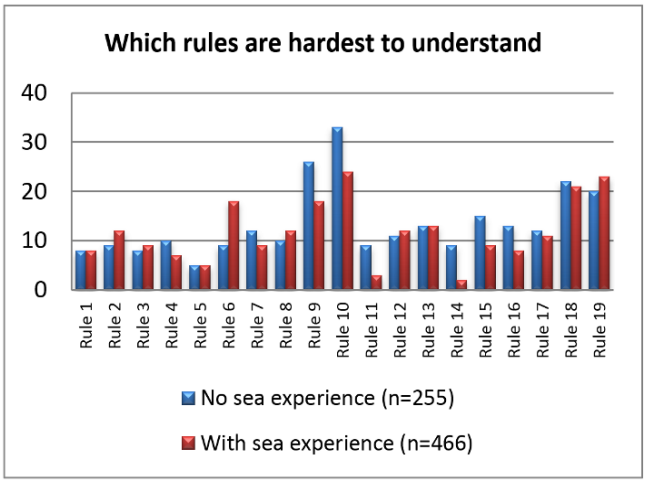

Figure 4. Rules are hardest to understand (No sea experience/with sea experience)

According to MET lecturers, rules which are most difficult for students to understand are Rule 19 (Conduct of the vessels in restricted visibility), Rule 18 (Responsibilities between vessels), Rule 10 (Traffic separation scheme), Rule 6 (Safe speed) and Rule 7 (Risk of collision), which are similar to answers given by other participants (See Figure 5).

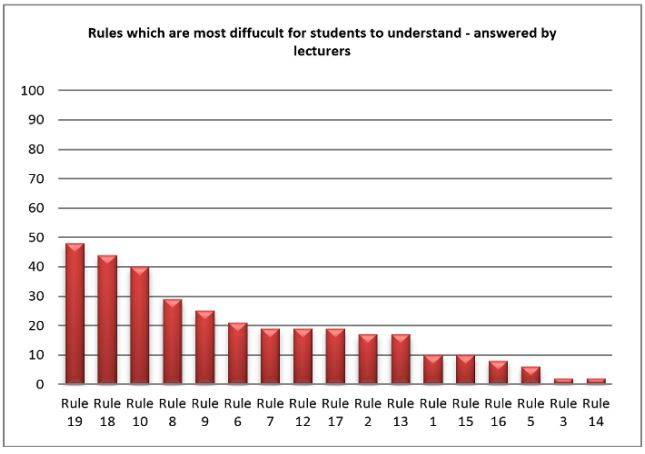

Figure 5. Rules which are most difficult to understand

The questions for maritime education and training lecturers show that over 63 percent of students have problem in interpretation of the rules (See Figure 6).

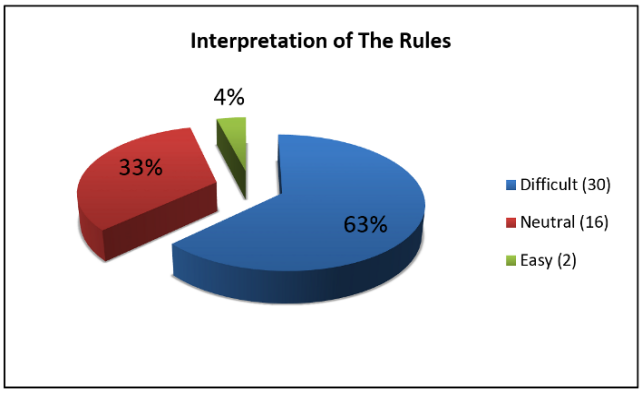

Figure 6. The problem in interpretation of the rules to students according to lecturers

This research clearly confirms that there are significant differences in the understanding and application of the Rules. It is concluded that the development of new methods and methodologies is needed for a better understanding of the Rules. Results of the questionnaire are used to run workshops in each partner country in order to verify the results and findings of questionnaire and gap analysis. Workshops were held for seafarers on merchant ships, teachers and lecturers in maritime institutions, VTS operators, employees of the Port authorities and pilots. Each partner prepared a workshop report and all workshop reports were collected by lead partner.

As a partial result of the project done so far, the following temporary inferences could be made:

- The existing rules have to be interpreted precisely so that they are understood in the same way by everyone.
- The rules that have priority over the others have to be clearly determined and navigation officers should be able to apply them without having a difficulty. So the bigger part of training scenarios should be based on these rules.
- Establishing a common understanding of an individual rule through some kind of guidelines and standardizing the education, training and assessment of COLREGs through the proposed COLREGs Model Course are needed. Partners are of the view that the COLREGs model course should be an integral part of the STCW.
- In some rules, certain definition(s) should be added in order to clarify the rules
- Developing COLREGs e-course to be used with fundamental and cheaper means of information technology, rather than expensive simulators should be considered.
- To improve learning methodologies it is suggested to use multiple case real life study scenarios which cover each individual rule, Court decisions for interpretation of case studies, visual images, simulators, CADs and 3D dynamic animations.
- A Global COLREGs online test would be strongly supported and recommended. The test should be taken in English and in mother language.

3.3 *General Considerations which Highlight Future Studies*

Many accidents, resulting in a larger number of fatalities during the last few years, have focused attention on issues of maritime safety. Accident registrations reveal that human related causes have a large proportion. By looking at cultural aspects, one's understanding of the underlying mechanisms may lead to a possible risk of increasing accidents. Several constructs of culture and climate have appeared on national, organizational and safety levels (Havold, 2013). The education and training is an important tool to improve safety culture but not sufficient. To achieve improvement of a safety culture, we need full support of the maritime community with all aspects. Havold (2013) also states that "To be able to reduce the risk for accidents, there seems to be a need for coordination and the cultural perspective seems to be one that integrates and takes the many disciplines and multi-level nature of accidents and safety into account". The maritime administrations, labour unions and IMO are required to spend more efforts to establish new rules, regulations and procedures to improve safety culture as well as ship-owners are needed to allocate sufficient resources to support.

The application of COLREGs is actually the practice of risk assessment and risk management. Klimczak (2007) states that, "The Working on the risk assessments, we can improve our risk management plans which will help us to create our standing checklists before accident happens and to do list in case of an incident". Achieving what we need to improve scenarios in the light of the existing accident investigation reports is related to application of the COLREGs, then we should select the most applicable scenarios for training purposes. Based on these selected scenarios, we should study risk assessment and risk analysis techniques.

A holistic and formative course should be designed to meet the requirements of contemporary education system. Therefore, we must decide on the aim, objectives and learning outcomes for our training which will help us to decide on the content of the programme supported with the scenarios. The main part of the training should be constructed on a real time scenario and case studies.

Since most of the bridge operation systems became automated recently, nowadays ship handling is very much dependant to the information provided by automated systems. Considering the automation related failures which were mentioned earlier, this course programme should also cover the introductory subjects related to basic working principals, capabilities, weaknesses and limitations of the selected COLREGs.

4 WORKING GROUP STUDY ON COLREGS TRAININGS

A Working Group was established at Piri Reis University to investigate and formulate possible teaching methods for COLREGs courses delivered in the maritime education institutes, between 10th and 15th of October 2014. The group was consisted of 13 maritime lecturers who had sea experience between 4 to 18 years. 11 of them had Master's degree and 2 of them had PhD degree. The group followed the following agenda;

- Introduction of the existing studies on COLREGs,
- Discussion on the COLREGs Course Catalogs in different MET institutes based on the UNIMET studies which is a EU Project to unify MET programmes (www.unimet.pro),
- Introduction of SURPASS online teaching programme which is EU Project to improve a training programme to reduce the accidents due to automation failure (www.surpass.pro),
- Discussions on the COLREGs scenarios created for ACTs and M'AIDER Project which is a EU Project to create accidents scenarios in support of MET (www.maiders.pro),
- Discussions on different teaching methods for COLREGs courses,
- Presentation of different teaching methods for COLREGs courses.

The group reached the following results (solutions) after the detailed discussions on the subject;

- The use of simulators and practical exercises will facilitate in learning of COLREG rules.
- To obtain better application of the rules in emergency situations at sea, the BTM (Bridge Team Management) and BRM (Bridge Resources Management) courses should be based on "near miss collision scenarios" supported with communication exercises.
- In most occasions there is only a single person on watch on the bridge. Therefore, the training of a single OOW is as important as simulator training of a bridge team.
- The communication in an emergency situation in particular for a collision case should be included in COLREGs training scenarios.
- A particularly designed COLREGs course should be mandatory for definite periods for all OOWs.
- The application of COLREGs is based on three steps; "evaluation of the situation, decision to apply a respective rule and taking action." So, it requires navigators having a perfect knowledge of each rule and be able to decide the application in the light of respective rule.
- The COLREGs is directly related to safety at sea. Not only seafarers but also maritime administrations and ship owners should be keen to improve safety culture at sea.
- The MET institutions provide basic training. But the ship masters have a significant role to improve the experience of the young officers. They should be keen on onboard trainings and assessments. The teaching methods improved for MET should also be used for on board trainings by ship masters.

In the light of the results of the discussions, the group decided to develop a holistic and formative training method. In order to achieve the solutions mentioned in the previous paragraph, an effective and reliable method was proposed. After its possible outcomes were evaluated, the group agreed on a training method named as "Interlinked Echelons Training Method for COLREGs Courses" which

consists of four echelons; Classroom Teaching, Case Studies, Practice with stand alone computers based on simple scenarios and Bridge Simulator Practices based on more complicated situations mostly similar the M'AIDER type scenarios (See Figure 7).

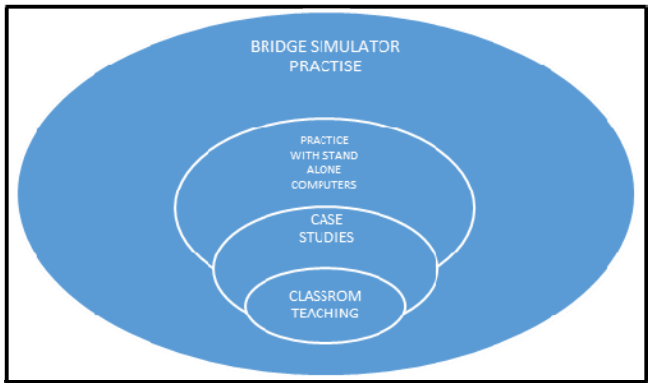

Figure 7. Interlinked Training Method for COLREGs Courses

Some group members have also proposed a linkage between different echelons of the training, such as a teacher might take the students to bridge simulator to explain a confusing situation or use stand alone computers by forming a bridge simulator session.

This kind of a training method will better meet the requirements of STCW fully by adequate use of simulators.

The courses should be included in the IMO model courses (MSC 90/16/126) to be considered as a part of international standards.

The method also presents some advantages such as; better understanding of case studies, and enhanced use of simulators. It is also believed that the proposed method provides more flexibility for the lecturers to use different training assets.

The Interlinked Echelons Training Method could provide the following additional benefits as well;

- Stand Alone Computer Practice (SACP) will help the students be prepared as OOW who will make decisions as a single OOW on the bridge,
- SACP will also allow application of CBA (Computer Based Assessment) which will provide better assessment for student's achievement,
- The case studies will help students make better decisions on different emerging collision situations.

Besides, there are some additional necessities to be met as well.

- Additional lecturers to handle stand alone computer practises assignments are required,
- In order to achieve an effective simulator training, there is a necessity of whether the number of the participating students be reduced or the number of the instructors be increased,
- The recommended guided learning hours in the Model Course 7.03 are required to be increased.

As a result of this working group study, it is decided that the results of the study should be reflected to the COLREGs course catalogs and be proposed to ACTs project team.

5 CONCLUSIONS

Although there are many discussions on the introduction (such as language used) and modifications of some rules of the COLREGs, it is unlikely to step forward on these issues in the near future. So it will be more useful to improve new learning methods for users to improve their skills to ensure better application of the rules at sea.

The use of simulators and practical exercises will facilitate learning of COLREGs rules. For better application of the rules in emergency situations at sea, the BTM and BRM courses should be based on near miss collisions scenarios supported with communication exercises.

The application of COLREGs is based on "evaluation of the situation-decision to apply a respective rule-taking action". So it requires navigator to have a perfect knowledge of each rule and be able to decide the application in the light of respective rule.

The COLREGs trainings in the MET institutions should be reconfigured to create better understanding for the cadets and to prepare them for their duties as OOW. A specially designed COLREGs course should be made mandatory for some defined periods for all OOWs.

In most occasions, there is only a single person on watch on the bridge. Therefore, the training of a single OOW is as important as simulator training of a bridge team. Using of stand-alone computers would be beneficial in improving the skills of the OOW for actions required to be done according to the COLREGs in emergency situations. The shipboard training is also important to improve young OOWs ability to react in near miss situations and ship masters should give more emphasis on this issue. They should be keen on onboard training and assessment. The teaching methods improved for MET may also be used for on board training by ship masters.

The COLREGs is directly related to safety at sea. Not only seafarers but also maritime administrations and ship-owners should be keen to improve safety culture as well as MET institutions.

The open access to European Union ACTs and M'AIDER projects results may be used for improving accidents scenarios for COLREGs training.

As a result of the working group study made in Piri Reis University, a holistic and formative training method which consists of four echelons is proposed. To achieve many different solutions defined by the group, an effective and reliable method is suggested and evaluated. This method called as "Interlinked Echelons Training Method for COLREGs Courses", a combination of "Classroom Teaching, Case Studies, Practice with stand alone computers and Bridge Simulator Practices" and proposed to be taken into consideration for future studies.

ACKNOWLEDGEMENT

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