Paper

A NEED FOR SOME CHANGES IN THE COLREGs, ITS TEACHING AND LEARNING FOR PREVENTING COLLISIONS AT SEA

Reza Ziarati, BSc (Eng), PhD (Eng), Cert Ed, CMechE, CElecE, CMarEng, CEng, FIMechE, FIET, FIMarEST[1]
Capt. Nicolai Velikov, PhD[2]
Capt. Djani Mohovic, PhD[3]
Capt. Himadri Lahiry[4]
Dr. Eng. Ersin OzTurker[5]
Dr. Basak Akdemir[6]
Capt. Robert Mohovic, PhD[7]
Capt. Renato Ivce, PhD[8]
Mag. Eng., Mate Baric[9]
Silja Teege[10]

1. Centre for Factories of the Future, Berekely House, Kenilworth, CV8 1EB, United Kingdom, reza.ziarati@c4ff.co.uk
2. Nikola Vaptsarov Naval Academy, 73, Vasil Drumev Str, 9026 Varna, Bulgaria, n.velikov@nvna.eu
3. University of Rijeka, Faculty of Maritime Studies, Studentska 2, 51000 Rijeka, Croatia, dmohovic@pfri.hr
4. Centre for Factories of the Future, Coventry, Puma Way, CV1 2TT, United Kingdom
5. Makro Ship Management Ltd., management@makroshipping.com
6. Bahcesehir Unıversıty, Engineering Management Department, Beşiktaş, 34353 Istanbul, basak.akdemir@eng.bau.edu.tr
7. University of Rijeka, Faculty of Maritime Studies, Studentska 2, 51000 Rijeka, Croatia, mohovic@pfri.hr
8. University of Rijeka, Faculty of Maritime Studies, Studentska 2, 51000 Rijeka, Croatia, rivce@pfri.hr
9. University of Rijeka, Faculty of Maritime Studies, Studentska 2, 51000 Rijeka, Croatia, mbaric@pfri.hr
10. Managing Director Sea Teach S.L. Port Petit 324 07660 Cala D'or Mallorca/ Spain, www.sea-teach.com

ABSTRACT

The term "navigation" implies actions undertaken to enable a vessel to sail safely from the port of departure to the port of arrival in a defined period of time. The navigation of the vessel is exposed to many dangers and accidents which can occur and may have far reaching consequences on people, society, property and the marine environment. By analysing maritime accidents in the past, it has been established that human error and incorrect interpretation of the Rules are the most frequent causes of vessels collisions. Recognizing this, the European Union approved the project "Avoiding Collisions at Sea" (ACTs) funded by the European "Leonardo da Vinci" programme. The purpose of this research was to identify

skill gaps in the knowledge and teaching of COLREGs (International Regulations for Preventing Collisions at Sea 1972 - Rules) for maritime professionals. The results have clearly identified gaps in the understanding of some parts of COLREGs due to the mis-interpretation and misapplication of the Rules. The only way to change this in the future is to improve learning methods, understanding and proper application of COLREGs inter alia using these research results. An investigation into collisions in multi-ship environments and situations in which more than one Rule is applicable, has shown that new learning materials and ship simulation scenarios could help in better understanding and application of the Sea Rules of the Road.

Paper

1 INTRODUCTION

This project was initiated by the Centre for Factories of the Future based in the UK. The Faculty of Maritime Studies in Rijeka was the leader of the first project called "Avoiding Collisions at Sea" (ACTs); the project was funded by EU Leonardo programme. The other partners were maritime training institutions from Great Britain, Spain, Slovenia, Bulgaria and Turkey. The second ACTs project known as ACTs+ was funded by the EU Erasmus+ programme. From the research evidence, 85% of all accidents are either directly initiated by human error or are associated with human error by means of inappropriate human response. Analysis shows that mistakes are usually made not because of deficient or inadequate regulations, but because the regulations and standards that do exist are often ignored. The IMO MSC clearly indicates that the causes of many of the accidents at sea are to result of deficiencies in the maritime education and training of seafarers or disregard for current standards and regulations. The MAIB (Marine Accidents Investigation Branch) safety study analysed accidents from 1994 to 2003, and established that 55% of all accidents were collisions. also It also noted that 19% of the vessels involved in a collision were completely unaware of the other vessel until collision and 24% of them were aware too late (the remaining 57% were aware of the other vessel). The EMSA (European Maritime Safety Agency) safety report also analysed accidents from 2007 to 2010. It shows that the total number of accidents, including collisions, is falling. However if the number of collisions is compared with other types of accidents it can be seen that collisions constitute 40% of all accidents.

By using a questionnaire, the authors studied the knowledge and understanding of COLREGs by nautical students and maritime professionals and non-professionals. The questionnaire was designed to test understanding of the Rules in order to see which parts were misunderstood. The questionnaire, in a paper form and on-line, was distributed within the EU and all over the world. All the various methods of learning the Rules used in different countries, therefore, have been included in the research.

Regardless of the learning methods used, the results of the questionnaire confirmed skill gaps among nautical students and experienced maritime professionals and non-professionals from all over the world. Identifying such gaps through the research results, allows for the development of a comprehensive and appropriate learning methodology.

2. INDENTIFICATION OF THE TRAINING NEEDS:

The questions were designed to determine which Rules are difficult to understand and which are most often broken in practice. Such questions are more difficult to construct than those which simply check knowledge. In a technical sense, the questionnaire was prepared in accordance with instructions from the professors from the Faculty of Humanities and Social Sciences in Rijeka, who are experts in dealing with teaching and assessment methods. Nevertheless, this was a very difficult task. Only 4 questions from the total of 372 from the MCA COLREGs test were included. Some graphical scenarios were also prepared and used in the questionnaire. This decision proved to be the right one as the graphical scenarios were the subject of many positive comments. Some respondents also referred to the language

used in the questionnaire as being "archaic", but it was agreed between the Partners that the questionnaire should use words and phrases from COLREGs (IMO) as much as possible.

The aim was to examine the understanding of certain Rules in whiche only two vessels were used in the scenarios. In practice, of course, multi-encounter scenarios are very common, but they were not used in the ACT project questionnaire. Once the final version of the questionnaire in the English language was prepared, partners from Croatia, Slovenia, Turkey and Spain translated it into their languages. The Slovenian Partner also produced the version for non-professionals. The questionnaire was made up of four groups of questions:

• General questions about respondents (12 questions).
• Questions that had an answer in COLREGs (34 questions).
• Questions for testing the opinions and actions of seafarers (12 questions).

This type of question was intentionally put to students in order to check if the professors had presented them with some situations and explained what they should do when appointed as junior officers.

• Optional questions for teachers and lecturers at maritime colleges (4 questions). General questions aimed at enabling the analysis and extraction of desired characteristic groups of participants in order to obtain detailed conclusions and comparisons among groups.

The group of questions that have an answer in COLREGs was the most important for determining which Rules are hard to understand. It also was also the subject of some comment because of its used of multiple-choice answers.

3. DATA COLLECTION

The questionnaire was distributed from January to the end of March 2014 through Lime survey and in a printed form. The results from the printed form were inserted into the Lime survey. The questionnaire was distributed to all maritime schools and colleges, as well as to seafarers on board merchant ships, teachers and lecturers at maritime institutions, VTS operators, employees of port authorities, and pilots, as well as to masters of fishing boats and yachts.

The Partners contacted crew managers who sent questionnaires both to all their vessels and to seafarers ashore as well. They also asked some seafarers to complete the questionnaire in their offices. High school and faculty students completed the questionnaire in their classrooms. The questionnaire was introduced and respondents were allowed to use books when filling it in. There was no time limit for completing the questionnaire. Using this approach, it was possible to fully test understanding of the Rules, because respondents were allowed to use all possible literature with no time restrictions. On average, respondents took 30-40 minutes to complete the questionnaire. This type of testing also avoided the stress that is usually present on board a vessel. By the end of March 2014, the questionnaire had been completed by 1280 participants (professional seafarers, maritime high school and faculty students) and 285 holders of licenses for various types of ships/boats (pleasure craft

and small fishing vessels). By January 2015, the questionnaire had been completed by 1498 seafarers and 288 non-professionals.

Most of the participants were maritime faculty students, ships officers and masters. Their ages ranged from 19 to more than 63 years and the most were from Croatia, Turkey, Spain and UK. On average, participants had over 5 years of sea going experience and most of them navigated on liquid cargo vessels, containers and bulk carriers. Also, 9% of participants had been involved in a collision and most of those collisions occurred in coastal waters or harbour areas and when visibility was over 6 miles. Only 34% of participants had attended some additional COLREGs training course.

4. ANALYSIS OF THE QUESTIONNAIRE RESULTS

Analysis on the understanding of the Rules showed that maritime education and training lecturers had the best results, followed by seafarers with sea-going experience, who had on average 15% better results than participants with no sea-going experience. The percentages of correct answers by participants with and without sea-going experience, and by maritime education and training lecturers, are shown in Figure 1. In the questions regarding Rule 10 (TSS), participants with no sea-going experience had more correct answers, while in the questions regarding Rule 17 (Action by Stand-on Vessel) and Rule 18 (Responsibilities between Vessels) the results obtained from all participants were similar. Moreover, the results obtained from high school and maritime faculty participants showed no difference in understanding of the Rules. Questions for testing the opinion of seafarers, like a minimum CPA, parallel course overtaking, and distance to start avoiding collision received various answers because there are no correct answers in the Rules, but again a difference between participants with and without sea-going experience was noted.

5. OUTCOME OF THE RESEARCH EVIDENCE,

This paper proposes a complete set of solutions based on research evidence of ACTs and ACTs+ projects.
In the ACTs project, an e-learning model was outlined for an encounter between two vessels and actions to be taken as per each collision regulation. In the ACTs+ project, for e-learning of COLREGS, the model was developed to include the simulation of the behaviour of more than two ships, at the entrance to harbours, in narrow channels and in high seas, so that the rules can be interpreted precisely, and can be understood in the same way by everyone, so avoiding ambiguity.

The COLRREGs rules and regulations include 5 parts and 38 rules. Among these rules and regulations, this paper mainly focuses on the Part B of the Steering and Sailing rules. According to the COLREGs, the collision situations between two ships can be divided into head- on, crossing and over taking to the route angle. And the own ship needs to give way to all ships that appear on its starboard side, and is not a stand on ship until all ships are on the port side.

In multiple ships scenarios, it is important to determine the relationships and hierarchy of the Rules to be applied for collision avoidance. Rules that have priority over others have to be clearly determined so that officers are able to apply them without difficulty.

In addition to explaining the rules, the manoeuvring characteristics of the vessel must also be included in order that correct decisions on taking appropriate actions to avoid collision can be made. Attempts were made in the on-going ACTs+ e-learning COLREGs course, to add as many as possible scenarios encountered in real life as possible, in order to improve learning methodologies for students and seafarers in a situation of multiple ships scenarios.
.
Under the general requirements of the International Regulations for Preventing Collisions at Sea (COLREGs), decision-making for anti-collision was analysed for both give-way and stand-on ships situations, including the emergency actions taken by ships. The stand-on ship is the ship which should get through the area as soon as possible by keeping its speed and course. Meanwhile, the give-way ship should change its speed and course in order to clear the area for the convenience of stand-on ship's passage. There are three kinds of the ship meeting scenarios, which are the head-on, overtaking and crossing. In the study of ship collision problems, it is important to establish the shortest distance at which collision does not occur and the nearest distance that two ships can pass each other safely,

CPA is the simplest and most effective means of predicting the target ship's position and estimating collision risk. In this paper, CPA is calculated every time to make sure that the path planning decision is safe and the ships have sufficient space to move, no matter whether ships change their speeds and courses. This means that during the time ships are take anti-collision actions, the CPA should keep larger distance than the set minimal value.

In case of collision avoidance of give-way ships, it is important to determine whether the own ship is the stand-on ship or the give-way ship, and then make the decision to make changes on the range and speed of the give-way ship and the stand-on ship if necessary.

A multi-ship collision avoidance decision-making and path planning formulation was studied in a distributed way. This paper proposes a complete set of solutions for multi-ship collision avoidance in intelligent navigation, by using a top-to-bottom organization to structure the system. The system was designed with two layers: collision avoidance decision-making and path planning. Under the general requirements of the International Regulations for Preventing Collisions at Sea (COLREGs), the performance of distributed path planning decision-making for anti-collision was analysed for both give-way and stand-on ships' situations, including the emergency actions taken by the stand-on ship in case of the give-way ship's fault in relation to collision avoidance measures.

6. GRPHFICAL ANALYSIS OF THE QUESTIONNAIRE RESULTS

The questionnaire results analysis for the understanding of the Rules showed that maritime education and training lecturers had the best results, followed by seafarers with sea-going experience who had on average 15% better results than participants with no sea-going experience. The results are shown in Figure 1.
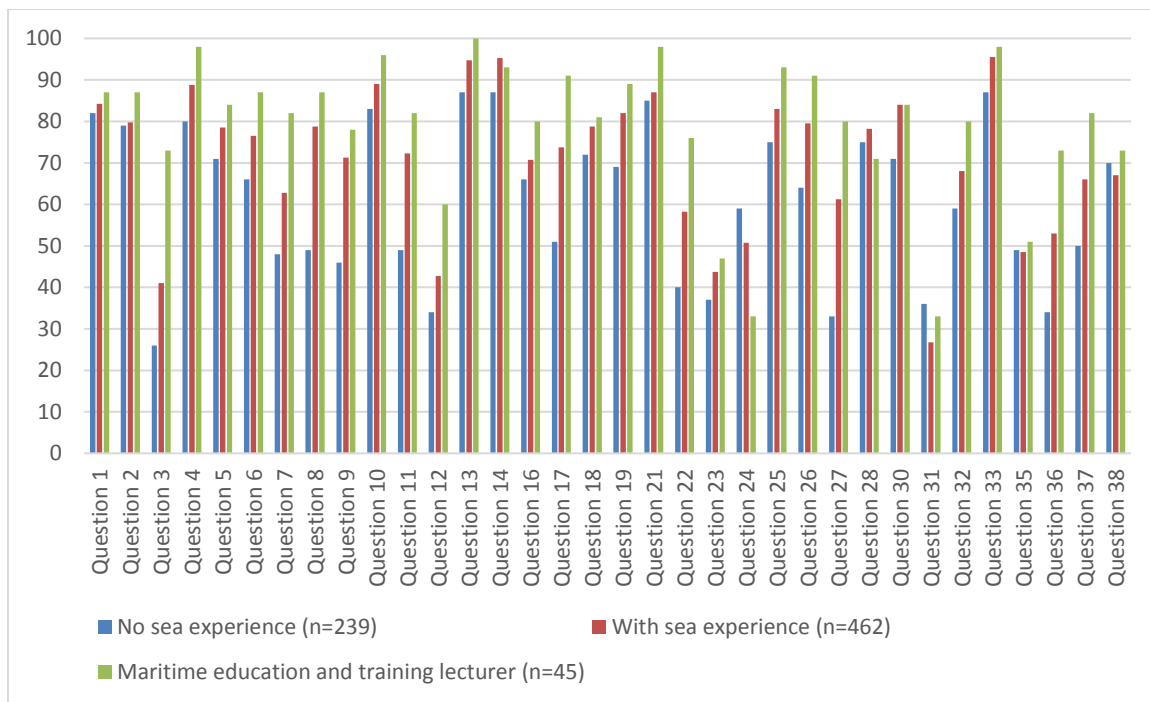
Paper

Figure 1: Percentage of correct answers by participant without and with sea experience and by maritime education and training lecturers

However, in the questions regarding Rule 10 (TSS), participants with no sea-going experience had more correct answers, while in the questions regarding Rule 17 (Action by Stand-on Vessel) and Rule 18 (Responsibilities between Vessels) the results obtained from all participants were similar. Moreover, the results obtained from high school and maritime faculty participants showed no difference in understanding the Rules.

Questions for testing the opinion of seafarers, such as in relation to a minimum CPA, parallel course overtaking, and distance for starting to avoid a collision, received various answers because there are no correct answers in the Rules, but a difference between participants with and without sea-going experience was again apparent as shown in Figure 2.
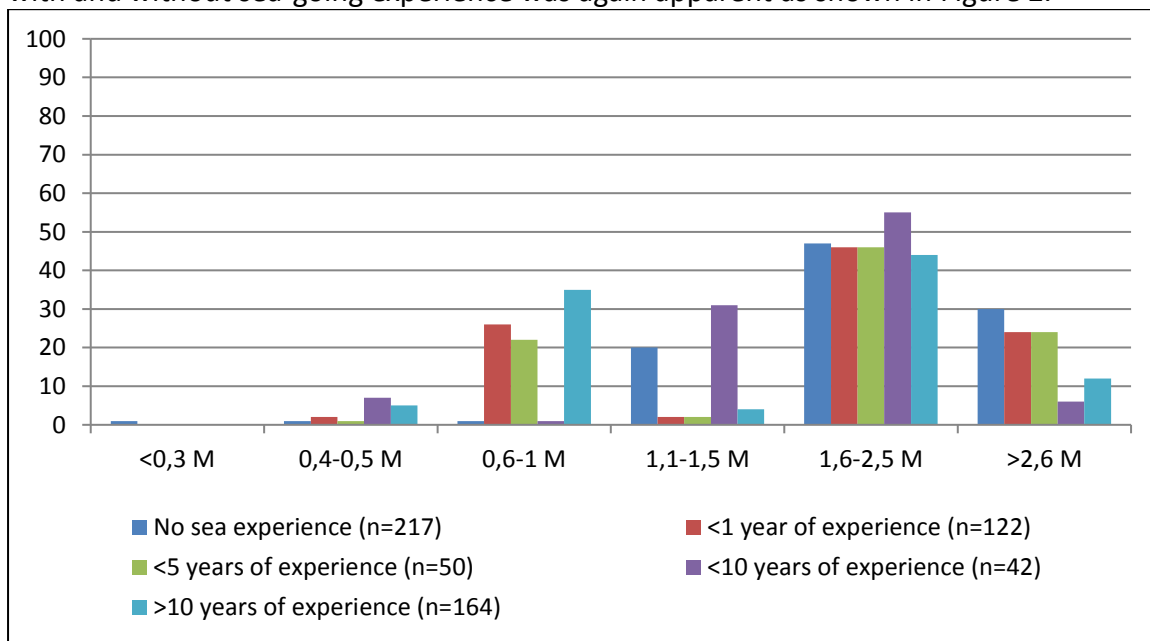

Figure 2: Percentage of answers for a minimum CPA opinion testing by different respondent groups

Paper

Rules which are hard to understand according to all participants are Rule 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). The results are shown in Figure 3.
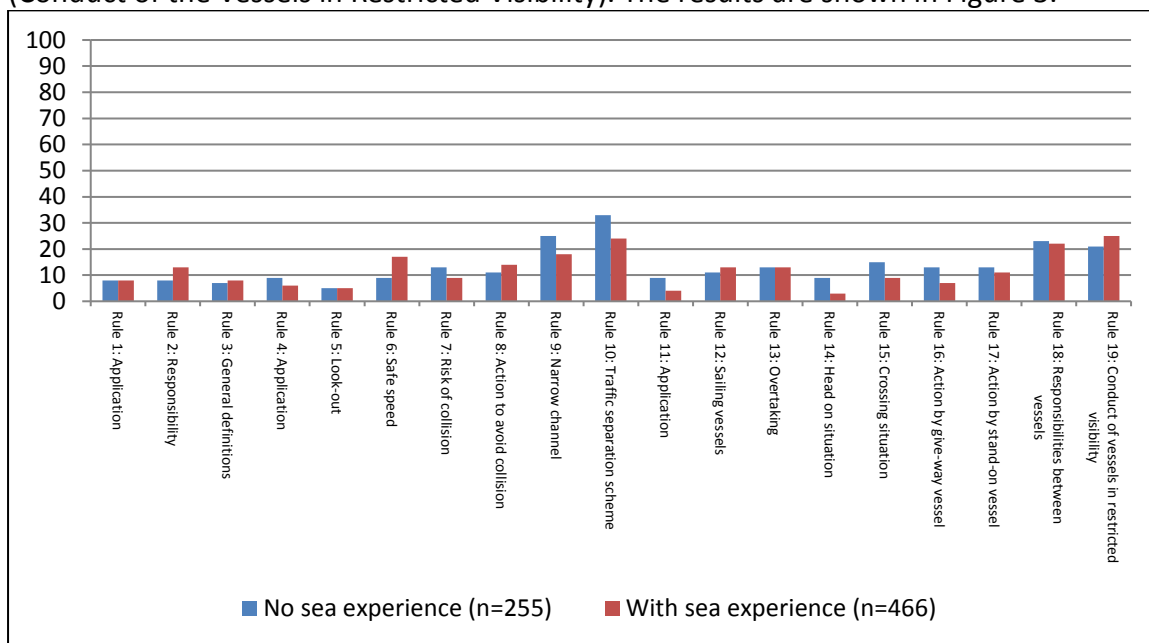

Figure 3: Rules which are most difficult to understand for participants without and with sea experience

Questions about using VHF in collision avoidance showed that participants with sea-going experience of less than 10 years more often use VHF in collision avoidance than participants with over 10 years of sea-going experience. Moreover, only 40% of those with sea-going experience used more VHF communication after AIS equipment became mandatory, and 70% believes that VHF contact could be useful for preventing collisions at sea.

Questions for maritime education and training lecturers showed that over 63% of students had problems interpreting the Rules.

According to maritime education and training 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). These answers are very similar to those given by other participants. The results are shown in Figure 4.
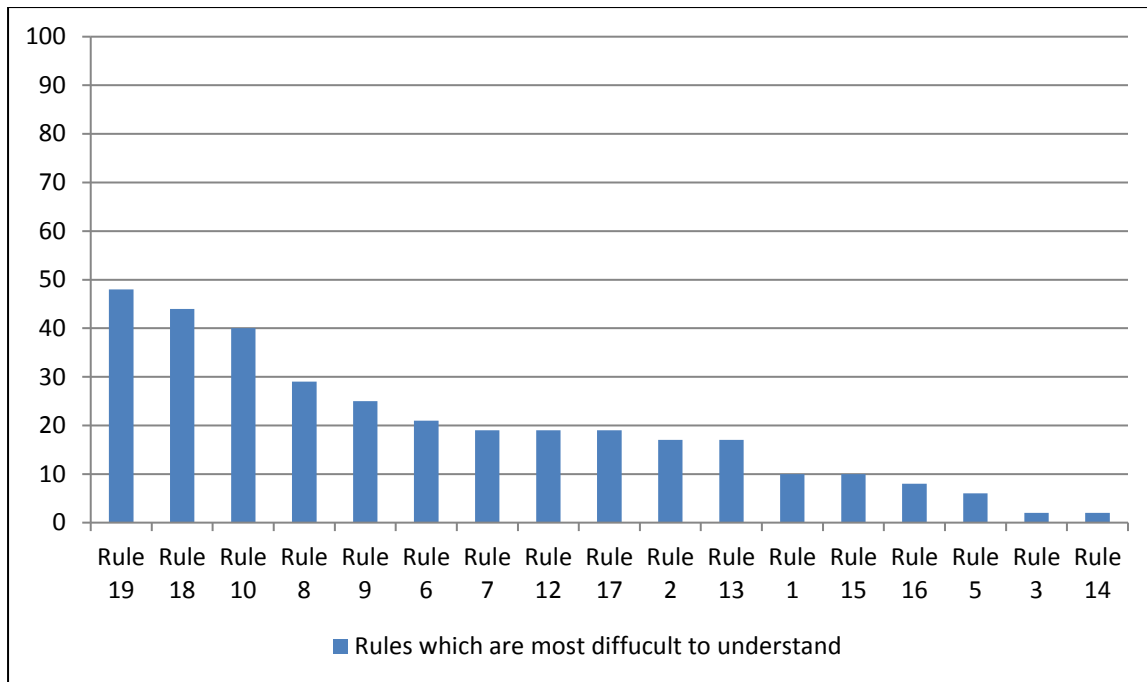
Figure 4: Rules which are most difficult for students to understand – answered by lecturers

7. VALIDATION OF THE QUESTIONNAIRE RESULTS

In order to validate the results of the questionnaire, workshops were organized in all of the partners' countries. The workshops aimed at presenting the results of the research, validating the results through discussion, discussing the methods of learning the Rules and determining the best way to use the results of the project for long-life learning.

In total, workshops were attended by 102 participants: teachers and professors at maritime colleges and faculties, seafarers, representatives of government authorities and maritime companies, pilots and members of various professional associations related to maritime shipping.

It was concluded that the results obtained were in accordance with the workshop participants´ opinions and that there is a strong need for the implementation of new methods of learning and teaching of COLREGs.

The questionnaire results and the conclusions from workshop discussions clearly confirmed that there are significant differences in the understanding and application of the Rules.

8. FINDINGS OF THE RESEARCH

Taking into account all the finding described above, the following conclusions can be drawn:

1. There is a need for change or review of the COLREGs. The rules need some minor changes or updates in accordance with evolving technology, and some drastic changes that are unlikely to be implemented. What is more important is that the existing rules must be interpreted precisely, so that they can be understood in the same way by everyone.

2. It is essential to determine the relationships and hierarchy of the Rules. Rules that have priority over others should be clearly determined and navigation officers should be able to apply them without difficulty. A flow chart showing the priority of the rules is suggested. This would also lead to the development of a sequence for learning/teaching the rules.

3. A common understanding of the Rules – a set of COLREGs guidelines – should be established. Establishing a common understanding of an individual rule through some clear Guidelines is needed, along with standardizing the education, training and assessment of COLREGs through the COLREGs Model Course. The COLREGs model course should be an integral part of the STCW. It is interesting that professional seafarers think that the Rules and literature for learning the Rules should be clarified, while non-professionals are satisfied with the learning materials. This has to be borne in mind when preparing the COLREGs Model Course.

4. There is a need for a further clarifications of some Rules. At each workshop, it was pointed out that certain rules should be clarified. In some cases,, specific definitions should be added in order to clarify the rules. While explaining the rules, the manoeuvring characteristics of the vessels should be included in order to make correct decisions on taking appropriate actions to avoid collision.

5. A brief COLREGs course a COLREGs e-course should be developed. The COLREGs course should be easy to use through simple information technology means, rather than requiring expensive simulators.

6. Considering the results of the ACTs questionnaire and the analysis of actual collisions, it is clear is that the Rules are not easy to understand or apply in certain cases.

7. In order to improve learning methodologies for the Rules for students and seafarers, the following is suggested:

– Use case study scenarios to cover each individual rule

– Include as many real-life scenarios as possible as within COLREGs training case studies

– Include both radar and bridge view in the case studies

– Use Court decisions for the interpretation of case studies

– Use as many visual images as possible to make teaching COLREGs more effective

– Use images, simulators, CADs and visual aids in training methodologies

– Use former accidents scenarios in an animated form

– Use 3D dynamic animations, covering day and night scenarios, in cases and examples used to support explanations of the rules

– Use multi-ship situation scenarios

- Use materials such as animated scenarios of the Rules so that cadets can see the Rules in action, and role play as vessels so that they can see the results of their decisions

- Scenarios must always be based on impartial reports (e.g. MAIB reports or similar) to ensure impartiality in the decisions and report findings used for the scenarios

- Use e-learning solutions, software, mobile apps to let students run short COLREGs

8. There is a need for official translation of COLREGs. Official translation of COLREGs into multiple languages could be carried out, but it is even more important that this is implemented for the explanations of the Rules.

9. COLREGs tests should be prepared in the mother tongue language as well as in English.

10. Special learning material and ship simulation scenarios are helpful in multi-ship collision environments and where more than one rule applies.

In Annex 1, the reasons behind the suggested changes to the COLREGs and/or teaching practice are presented for reference purposes.

9. CONCLUSION

The questionnaire results and conclusions of workshops clearly indicate problems in the understanding and application of COLREGs by nautical students and maritime professionals and non-professionals. As the research was conducted in the EU and worldwide, the results are particularly important because different learning methods were included in the survey and all showed the same deficiencies. This clearly shows that it is essential that the learning methods of COLREGs are improved in the future.

The ongoing work on the ACTs project includes the development of a new learning methodology which takes into consideration the research results and tries to improve the learning method by using scenarios created for each Rule. Reducing collisions at sea is possible through achieving a better understanding and application of the Rules by professional and non-professional seafarers, and it is believed that this new teaching methodology will contribute to that goal.

The second ACTs project (ACTs+) contains several scenarios for multi-ship environments and situations in which more than one Rule applies. Further information on the ACTs and ACTs+ projects can be found on the web page: www.advanced.ecolregs.com. The site presents all ACTs and ACTs+ scenarios supported by quizzes and more demanding assignments. The summary details of ACTs Plus are given in Ziarati et al (2017) and showing the efforts and endeavours put into improving the Sea Rules of the Road and hence making seas safer, is presented in Annex 2.

REFERENCES

[1] Acar, U., Ziarati, R., Ziarati, M. (2008). Collisions and groundings – major causes of accidents at sea. Marifuture papers: 48 - 51. http://www.marifuture.org/Publications/Papers/   Collisions_and_ groundings_major_causes _of_accidents_at_sea.pdf (last accessed, November 2014).

[2] Acar, U., Ziarati, R., Ziarati, M. (2012). An investigation into COLREGs and their application at sea. Marifuture papers: 40-47.

[3] European maritime safety agency. (2010). Maritime accident review. http://emsa.europa.eu/publications/technical-reports-studies-and-plans/item/1219-maritime-accident-review-2010.html (last accessed, September 2014)

[4] Macrae, C. Human factors at sea: common patterns of error in groundings and collisions. Maritime Policy & Management: The flagship journal of international shipping and port research: 33.

Related publications reviewed:

 (1)   [5] Acar, U., Ziarati, R., Ziarati, M. (2008) Collisions and groundings – major causes of accidents at sea. Marifuture papers: 48 - 51. http://www.marifuture.org/Publications/Papers/ Collisions_and_ groundings_major_causes _of_accidents_at_sea.pdf (last accessed, November 2014).

[2] Marine Accident Investigation Branch. (2004) Bridge watch keeping safety study. http://www.maib.gov.uk/cms_resources.cfm?file=/ Bridge_watchkeeping_safety_study.pdf (last accessed, November 2014).

[3] European maritime safety agency. (2010) Maritime accident review. http://emsa.europa.eu/publications/technical-reports-studies-and-plans/item/1219-maritime-accident-review-2010.html (last accessed, October 2014)

[4] IMO Publications (2003). *COLREG – Convention on the International Regulations for Preventing Collisions at Sea 1972*, Consolidated Edition 2003, London.

[5] Maritime professionals' on-line survey: http://limesurvey.c4ff.co.uk/index.php?r=survey/index/sid/613743/lang/en (last accessed, January 2015).

[6} *Ziarati, R., et al, (2017),* Avoiding Collisions At Sea – Pareto Analysis, Preliminery paper, IAMU conference proceedings, 2017, Varna. Bulgaria, October 2017.

[7] Mohovic, D., et al, 2018, Avoiding Collisions at Sea – From Multi-Ship To Ship-To-Ship Encounter, International Maritime Lecturers Association conference, Manila, Phillipine, 2018.

For Annexes 1 and 2 see the following pages.

Annex 1

Joint report from all ACTs+ workshops regarding the proposals for improvements of COLREGs training needs

1 – Determine relationships and hierarchy of the rules

The present collision regulation does not cover multiple ship scenarios.

In a case in which more than one rule is involved/referred to (when one rule states the exceptions to this specific rule) seafarers tend to misinterpret and may get confused. This causes a problem in prioritizing the rules according to the given situation and defining the relationships and hierarchy of the rules. (PRU, C4FF)

Conclusion 1: rules which have advantage. Is it possible to show this with a flow chart? Determine the sequence of learning rules. Rules should be taught in sequence, and then each rule and its hierarchical position should be explained.

2 - Need for change or review of the COLREGs

1. The principle of evolution not revolution should be applied in reviewing the rules because the current COLREGs rules have been tested in courts and developed a body of precedents and case law. (C4FF)

2. The existing rules are deemed to be sufficient. (PRU)

3. The Rules are hard to understand and to apply, but it is not likely that they will be changed in the light of different conditions on ships, equipment, situations. (UoR)

4. As can be seen from our discussion, the Rules are a bit archaic and require certain changes and improvement / upgrading. (UoR)

5. Regarding the COLREGs review, opinions range from hard rejection through cautious consideration to acceptance. Most of the masters with long experience consider COLREGs to be good enough. Some agree that some clarifications are needed in the COLREGs text. (NVNA)

6. Maybe the rules could be changed, but maybe, as with the aviation system, the coastal and harbor areas of the sea could be controlled by regional/national traffic controllers. (Sea Teach)

Conclusion 2: The rules would have to have some minor changes or updates in accordance with technology, but drastic changes are unlikely. It is more important that existing rules are well explained so that they are understood in the same way. Who has to change the Rules? IMO?

3 – Establishing a common understanding of the rules – COLREGs guidelines?

1. Establishing a common understanding of an individual rule. (PRU)

2. It was generally agreed that standardizing of the training and assessment of COLREGs would be useful and important. (NVNA)

3. Better Train the Train resources should be made available for COLREGs, e.g. what to teach, how to teach it, who to assess that the students have understood and can apply what was taught etc. (C4FF) Trainers should use several real-life case studies so that learners can learn and have the confidence to take appropriate action when required.

4. It would be good to develop IMO guidelines which explain the Rules. Every additional explanation is good, but that requires lot of hard work and unification of the application of the Rules. (UoR)

5. Are existing tools for teaching COLREGs useful? Answer: Acceptable. (Sea Teach)

Conclusion 3: Establishing a common understanding of an individual rule through a set of Guidelines. Who should make this manual? An expert group organized by the IMO? Standardizing of the training and assessment of COLREGs through a COLREGs Model Course

is a way forward. Who should make the content of COLREGs Model Course? An expert group organized by the IMO? The COLREGs model course should be an integral part of the STCW. It is interesting that professional seafarers think that the Rules and literature for learning the Rules should be clarified, while non-professionals are satisfied with materials for learning. Is the reason for this conclusion the fact that the application of the rules on small and large vessels differ? Since every close quarters situation is different, the action to be taken by seafarers depends a lot on the experience and judgement of the officer on watch.

4 – The need for an explanation of some rules

1. The problem with implementation of the COLREGs seems to be *individuals' different interpretation of the rules* as well as *the way seafarers perceive the situation*. (PRU)

2. Short explanations on vague items, such as safe speed, impede, ordinary practice of seaman etc., could be introduced. (PRU)

4. The problem in the application of Rule 10 in the TSS is that there is no particular way to determine if the vessel is less than 20 m or lnot. The problem for larger vessels when encountering smaller vessels is in bridge visibility which depends on ship type, trim, deck cargo. (UoR)

5. In the Rules, there is no clear statement about when the obligation for collision avoidance starts (When you first see it? When you first see it in what way? Visually? On the radar? What if visibility is bad? What if ships change their course due to configuration of fairway?). (UoR)

6. It is recommended that numeric values of safe speed be determied, because one of the most common reasons for collision is excessive speed. It is interesting that ISM define many things on the vessel. By company regulation CPA is defined, but there is no mention of safe speed. That decision is left to the Master or OOW. (UoR) Safe speed may differ depending on the size and manoeuvring ability of the ship.

7. It would be good to explain terms which are used on vessels, for example Sea speed, Manoeuvring speed, Engine ready for immediate use, Crash manoeuvre. Defining these terms would minimize commercial pressure on the Master and OOW. (UoR)

8. Areas with thicker traffic (such as TSS), where there is nto enough maneuvering space, navigational dangers are not recognized and there is no knowledge in ship maneuvering characteristics (turning circles, stopping way, slow down, crash maneuvers), are problematic. (UoR)

Conclusion 4: At each workshop, it was pointed out that certain rules should be clarified. In some rules specific definitions should be added in order to clarify the rules. In explaining the rules, the maneuvering characteristics of the vessel should be included in order to that correct decisions about taking appropriate actions to avoid collision can be taken.

5 – Establishing a short COLREGs course

1. In developing a COLREGs E-course, special attention should be given to interactive 3D case studies in support of COLREGs Rules explanations. (NVNA)

2. It would be good to have COLREGs as a separate short course (Assessed and Certified) supplemented to any education and training program. (C4FF)

3. It would be good to have COLREGs as a separate short course (Assessed and Certified) supplemented to any education and training programme. Answer from non-professionals: Yes, good idea. (Sea Teach)

4. Would it be good if there was a special course about the rules in addition to existing training programs for seafarers? Each learning and "refreshment" of knowledge is positive -

ships are getting bigger, traffic is thicker, speed is increasing and therefore there is no room for mistakes. (UoR)

Conclusion 5: Develop a COLREGs e-course. A COLREGs course should be possible using simple information technology, rather than expensive simulators. Should extra courses be mandatory or optional? Professionals disagree with mandatory courses!

6 – Are the Rules easy to use or not?

1. Are the existing COLREGs rules clear and easy for all to use? Mostly: Yes they are. Some rules may need further explanation, however making the rules any longer than they already are will not help. (PRU)

2. Most of the workshop participants agree that the Rules are not easy to use. (UoR)

3. Are the existing COLREGs rules clear and easy for all to use? Answer from non-professionals: Yes (majority decision). (Sea Teach)

Conclusion 6: Opinions about this issue are very divided. Our opinion from the ACTs questionnaire and analysis of actual collisions is that the Rules are not easy to understand or apply in certain cases.

7 – Methodology for learning the Rules for students and seafarers

1. Having multiple case study scenarios to cover each individual rule and practicing with them was suggested as a solution. (PRU)

2. The common suggestion to help overcome COLREGs difficulties was to include as many real-life scenarios as possible within COLREGs training case studies. (PRU)

3. The workshop participants stated that the radar scope together with the bridge visual can be good assets to include in the case studies. (PRU)

4. For teaching purposes, court decisions may lead the way for interpretation. (PRU)

5. There should be more visual images to make them more effective. (PRU)

6. Which training methodologies would make learning and interpreting the rules better? Mostly: Images, simulators, CADs and visuals may help. (PRU)

7. Past accident scenarios in an animated form aid teaching/learning COLREGs. (PRU)

8. Suggested using 3D dynamic animations, covering day and night scenarios, when cases and examples are used to support explanations of the rules explanations. (NVNA)

9. Most teaching scenarios for COLREGs are based on two ships. However in the real world, it is very common to be in a multi ship situation. Students should be taught COLREGs in these situations because then the answer isn't so simple. (C4FF)

10. Need to engage the cadets, so use materials such as animated scenarios or gameification of the rules so cadets can see the rules in action and role play as the vessels to see the results of their decisions. (C4FF)

11. Using past accident scenarios in an animated form aids teaching/learning COLREGs. It makes COLREGs more practical when cadets can apply the theory of the COLREGs rule to real life situations they may encounter. (C4FF)

12. Scenarios must always be based on impartial reports (e.g. MAIB reports or similar) to ensure impartiality in the decision and report findings used for the scenarios. (C4FF)

13. The point of learning based on past scenarios is to recognize the chain of events that led to the accident. (C4FF)

14. There are currently no engaging e-learning solutions, software, mobile apps to let students run short simulations and test out their COLREGs knowledge. This could be a very valuable tool. (C4FF)

15. Scenarios that are possible in practice in the Rules are not clearly defined. Does that mean that the Rules are not clear enough and should be more specific? How can such cases be explained to the students? (UoR)

16. Interpretation of the Rules or specific scenarios should more often refer to court order practice. This gives clearer answers on real situations. (UoR)

17. During the teaching of the Rules in schools and faculties, court practice should be used more often in the analysis of collisions which have occurred. (UoR)

18. First, the rules should be learned with understanding, and then the rules should be applied on simulators starting from their basic application and use (overtaking or opposite course with one ship and in good visibility conditions) to more demanding situations and multiple applications of more rules. (UoR)

19. In the development of scenarios used to explain the rules, VDR data should be used. The question is how to get these data, as we are limited in time and VDR application on board.

20. The participants agreed that this is a boundary case which cannot be explained clearly without a video presentation. (SPIN)

21. Access to video supported explanations of COLREGs would be beneficial, but it must be effective as non-professionals won't invest too much time refreshing the COLREGs regularly. (SPIN)

22. Past accident scenarios would also be ok, but only if they could be simplified to be shorter. (SPIN)

23. For better learning and interpreting the rules, we suggest that animations of real collision situations (past accident scenarios) be produced to see what went wrong, who made mistakes, and when? (Sea Teach)

Conclusion 7: The suggested way to improve learning methodologies is:

1. Multiple case study scenarios to cover each individual rule

2. Including as many real-life scenarios as possible within COLREGs training case studies

3. Including the radar scope together with the bridge visual in case studies

4. Court decisions may lead the way for interpretation of case studies

5. More visual images to make teaching COLREGs more effective

6. Training methodologies: use of images, simulators, CADs and visuals

7. Past accident scenarios in an animated form

8. Using 3D dynamic animations, covering day and night scenarios, when cases and examples are used to support explanations of the rules

9. Use of multi ship scenarios

10. Use of materials such as animated scenarios or gameification of the rules so Cadets can see the rules in action and role play as the vessels to see the results of their decisions

11. Scenarios must always be based on impartial reports (e.g. MAIB reports or similar) to ensure impartiality in the decision and report findings used for the scenarios. Our opinion is that court decisions (suggested by many participants ar the workshops) and other sources should only be used when we are 100% certain about conclusions.

12. VDR data should be used in the development of scenarios to explain the rules.

13. Use e-learning solutions, software, mobile apps to let students run short COLREGs simulations and tests

14. Court practice and analysis of collisions which have occurred should be used more during the teaching of the Rules

15. Case studies should use video presentation

16. Video supported explanation of COLREGs would be beneficial, but they should be effective as non-professionals won't invest too much time to refresh the COLREGs regularly. For non-professionals, prepare simplified video supported explanations.

8 – There is a need for official translation of COLREGs

1. Issue official translations of the COLREGs (COLREGs already has 3 official translations: English, French and Spanish). (C4FF)

Conclusion 8: Official translation of COLREGs into multiple languages could be made, but it is even more important that the explanations of the rules are translated. Who is authorized to arrange an official translation of COLREGs? IMO?

9 – Rules which are hardest to understand

1. Most of the participants agreed with the results. According to the results, the Rules which are hardest to understand are Rules 9, 10, 18 and 19. Rule 13 is also hard to understand. Rule 6 is also one of the Rules which are hard to understand for participants with seagoing experience. (UoR)

2. The participants confirmed that the rules which came out of the survey as the hardest ones to understand are the hardest to them as well. These are: Rule 4, Rule 10, Rule 18, Rule 19. (SPIN)

Conclusion 9: Professional and non-professional seafarers find a similar set of rules particularly hard to understand. Should we primarily focus on these in preparing scenario explanations of COLREGs? We think this would not be enough and that such explanatory scenarios should be developed to cover all the rules.

10 – COLREGs test in English and the mother language

1. Should the COLREGs test be in English? Other nationalities may object to the test being in English What are your thoughts on this? Answer: The test should be in English and in the mother tongue. (Sea Teach)

2. A Global COLREGs online test would be strongly supported and is recommended. The test should be taken in English and in the mother tongue (so there is no misunderstanding of the rules) and the test should be re-taken at regular intervals, say every three years. (Sea Teach)

Conclusion 10: The COLREGs test should be prepared in the mother language and in English.

Annex 2
The Brief History of COLREGs

The main reason for including an annex on the history of COLREGs developments is to show the past struggles and endeavours in trying to make the sea safer for the seafarers and indeed for all users of the sea, as a passenger on a liner or a sailor in a small craft.

COLREGs, or The International Regulations for Preventing Collisions at Sea, is the latest official name for the Regulations. In a book by David Thomas it is stated that the collision-prevention regulations are not very clear to nor confirmed by all seafarers . There has been a lot of confusion among mariners but, due to lack of time or sometimes even confidence, no one seems to feel comfortable enough to raise questions. Because seafarers do not fully understand the rules, they do not know how to act accordingly, resulting in a job half done.

In the late 1970's David Thomas became involved in research on the use of VHF R/T communication between ships avoiding collision and in collaboration with Dr. Andre Corbet published a few articles criticising the published rules. As a result, some recommendations were made about giving more definite guidance to seafarers navigating through fog. Unfortunately, despite the overwhelming number of simulating exercises proving the flaw in the existing rules, the proposed change was not approved.

Evidence of the first rules or laws regarding collisions at sea dates to back to the 3rd to 2nd Century BC. However, the problem was that the laws concerned discipline on board of the ship, the safety of freight and liability for property damage. No specific guidance on avoiding collisions at sea was mentioned. In the 13th Century the laws were adopted across Europe, including the by English Court of Admiralty.

1338 – The appearance of the first true rule for collision avoidance. It concerned the senior ship having the right of way and meant, that, for instance, a captain, had to give way to an admiral.

At the beginning of 18th century, the next important rule, the 'port-tack' rule, came into practice. Iit was mandatory for warships and required ships on the port tack to bear up for others on the opposite tack.

1831 - It was ruled that "steamships approaching each other end-on modify course to port to pass starboard to starboard".

1839 - Steamships were required to keep to starboard in open waters as well as narrow channels. In other words, ships were to take action to avoid the collision even before the threat for collision appeared.

1846 – An act came into law which required a steamship's helm to be turned to port when meeting another end-on. Moreover, it was required from then on for the ships to keep to starboard in rivers, narrow channels and when meeting at any angle in open waters.

Many believed that the rules were useless or dangerous and therefore in 1860 the Commons Select Committee on Merchant Shipping reported that the rules were unsatisfactory. Two years later the new rules appeared as an amendment in the Merchant Shipping Act. These rules discussed the appropriate actions for eight collision risks and by 1865 they were all adopted by more than 30 countries. It was only at that time that special circumstances were mentioned in the rules, allowing a ship's crew to go against the rules all together if that made for a better chance of avoiding collision. The rules also abandoned the need to keep to starboard in narrow channels: there was no mention of the speed of the stand-on vessel which could cause a potential hazard. In 1879 the rules were amended again and the rule of keeping to starboard in narrow channels came back into force.

1889 - More changes were made at the International Maritime Conference in Washington DC. From then on the stand-on vessel was to keep its speed and course and any crossing steamships were to give way.

1910 – The rules are redrafted at an International Conference in Brussels, allowing the stand-on vessel to take action if the action from the other ship was insufficient to avoid collision.

1933 – A new rule was put in place requiring that the helm order would apply in any case to the direction in which rudder was to be turned.

1948 – More changes were made at the SOLAS conference. It was stated that the possession of radar should not excuse the ship's crew from using the rules. There were also some more changes regarding whistle and lighting

1960 – At the next SOLAS conference discussions about radar were held but it was clearly stated that radar is inferior to the rules and should only be taken into account when the other vessel cannot be seen or heard.

1977 – Another version of rules came into existence. From then on the stand-on vessel was allowed to take collision avoiding action as soon as the watchkeeper decided the other vessel was not taking appropriate action or was not doing so fast enough. Radar was recognized but it was pointed out that the information taken from radar alone was not sufficient to allow the watchkeeper to apply the rules accordingly.

According to the author, most of the rules did not make much sense. They were telling the ship to sit its course when in fact the natural way of avoiding collision would be to turn away from the threat, so mariners needed to decide whether to follow the ridiculous rules or their own self-preservation instincts. It was very difficult for mariners to make the right decision: avoid collision by going with what's right or simply follow the rules and collide with the approaching ship. Either way they could face serious consequences and end up in court defending their actions because the rules were not fit for the purpose of helping seafarers to avoid collisions.

A single collision should be enough reason to question such rules, and if there are many more collisions it is clear that those rules do not really work and should be changed. The aim of the rules should be to prevent collisions from happening, not to be used to settle disputes after a collision has happened. This would definitely help mariners to make the correct decisions and it would also help court to make the right judgment if it comes to disputes.