Gap Between Detailed Information by Navigational Equipment and COLREGS Rule 19

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Abstract
Navigational equipment is used to render accurate numerical data to Officers on Watch (OOW) so that they can maneuver well and navigate vessels safely. However, from the aspect of OOW, sometimes the large amounts of information and data generated by navigational equipment can be difficult to understand. COLREGS aren't always as useful as they need to be; they are collision avoidance rules that lack technical advice, which can occasionally cause problems for OOW during navigation. For example, COLREGS Rule 19 is generally defined as “Conduct of vessels in restricted visibility”. However, COLREGS do not provide any numerical standard for restricted visibility conditions that are necessary for the OOW, such as the specified values or numbers for vessel maneuvering.

A brief summary of missing information from the COLREGS is as follows: ① Vessel size creates different time lags of reaction between ships or vessels after a “risk of collision” has been identified, ② The confusion of applying Rule 18 or Rule 19, ③ The failure to clarify current visibility as good or poor; and ④ Over-reliance on the information and data generated by navigational equipment. These four interconnected factors contribute to collision accidents under restricted visibility conditions.

After an introduction to the legal background in this paper, the authors will further analyze the data collection from real collision cases, and finally conclude with some proposals to solve the problems outlined, as well as the directions for future research.

Keywords: Nautical Rules of the ROAD, COLREGs, Information of navigation, Navigation instruments, Accident analysis

1. BACKGROUND
1.1 COLREGs and Information by Navigational Equipment
The International Regulations for Preventing Collisions at Sea have evolved from the international customs of seamen. ¹) Therefore, specific details (time and distance) were not clearly stipulated in the COLREGS for collision avoidance actions. COLREGS prescribed some prohibitions for collision avoidance actions; in reality, however, the OOW should make judgements to avoid collisions by him/herself. On the other hand, with the help of highly developed navigational equipment, the OOW has access to detailed information from navigational equipment that can help to inform decisions.

In particular, even in restricted visibility conditions, most vessels can sail in the same way as in good conditions, due to advancements made to RADAR in recent years. The 1972 COLREGS was carried out based on “the RADAR information was sufficiently reliable information.” and “the safety could be improved by RADAR information of trust.”

The navigational equipment provides accurate numerical information to the OOW. The OOW navigates on the basis of information from the navigational equipment.

In the current situation, COLREGS hold numerical standards and Navigational equipment provide detailed information that could not be known by human sense.

The above situation pertains to COLREGS Rule 19 “Conduct of vessels in restricted visibility.” COLREGS hold the numerical standard, however, as they provide the requirements used to make decisions using detailed
information for the OOW. The authors thought the above situation had made decision-making more difficult for the OOW during navigation. In this paper, the authors point out the contradictions in the above situation by example the actual collision accidents.

1.2 The meaning of restricted visibility

 Restricted visibility is prescribed by the CORLEGS Rule 3 (g) as follows;
The term “restricted visibility” means any conditions in which visibility is restricted by fog, mist, falling snow, heavy rainstorms, sandstorms or any other similar causes.

In the 1960 COLREGS, “restricted visibility” had been provided in Rule 15 and 16. In the 1972 COLREGS, it had been provided in Part A - General Rule 3.

2. CHANGING NAVIGATION RULES IN RESTRICTED VISIBILITY

The handling of radar was discussed for the first time in the 1948 COLREGS. The restricted visibility navigation rule had been provided by the 1960 COLREGS for RADAR equipped vessels. COLREGS then went through large revisions in 1972.

The provisions of the constitution and terms are significantly different in the 1960 and 1972 COLREGS. This paper will overview the 1960 COLREGS and 1972 COLREGS about the configuration and the wording of provisions individually.

2.1 1960 COLREGS

1960 COLREGS were composed of the following contents;
Part A - Preliminary and definitions (Rule 1)
Part B - Lights and shapes (Rule 2 - 14)
Part C - Sound signals and conduct in restricted visibility
   (the preamble, Rule15,16)
Part D - Steering and sailing rules
   (the preamble, Rule17 - 27)
Part E - Sound signals for vessels in sight of one another
   (Rule 28)
Part F - Miscellaneous (Rule 29 - 31)

The 1960 COLREGS had been made up in the same effect as Rule 19, 33 and 35 in 1972 COLREGS. The Rule 16 of 1960 COLREGS states;
Rule 16
(a) Every vessel, or seaplane when taxi-ing on the water, shall, in fog, mist, falling snow, heavy rainstorms or any other condition similarly restricting visibility, go at a moderate speed, having careful regard to the existing circumstances and condition.

(b) A power-driven vessel hearing, apparently forward of her beam, the fog-signal of a vessel the position of which is not ascertained, shall, so far as the circumstances of the case admit, stop her engines, and then navigate with caution until danger of collision is over.

(c) A power-driven vessel which detects the presence of another vessel forward of her beam before hearing her fog signal or sighting her visually may take early and substantial action to avoid a close quarters situation but, if this cannot be avoided, she shall, so far as the circumstances of the case admit, stop her engines in proper time to avoid collision and then navigate with caution until danger of collision is over.

“Moderate speed” is defined as follows; “The object of rule 16 is not merely that vessels should go at a speed which will lessen the violence of a collision. It is also that they should go at a speed which will not unduly reduce the time available to vessels approaching each other to hear each other’s fog-signals and make it more difficult or even impossible for them to hear those signals, and which will give as much time as possible for avoiding a collision, when another ship suddenly comes into view at a short distance.”

The advent of the RADAR had been greatly affected was the first half of Rule 16 (c). The “Recommendation on the use of radar information as an aid to avoiding collisions at sea” had shown as follows; [3]

➢ When action has been taken under Rule 16(c) to avoid a close quarters situation, it is essential to make sure that such action is having the desired effect. Alterations of course or speed or both are matters as to which the mariner must be guided by the circumstances of the case.

➢ Alteration of course alone may be most effective action to avoid close quarters provided that:
   (a) There is sufficient sea room.
   (b) It is made in good time.
   (c) It is substantial. A succession of small alterations of course should be avoided.
   (d) It does not result in a close quarters situation with other vessels.

➢ The direction of an alteration of course is a matter in which the mariner must be guided by the circumstances of the case. An alteration to starboard, particularly when vessels are approaching apparently on opposite or nearly opposite courses, is generally preferable to an alteration to port.

➢ An alteration of speed, either alone or in conjunction with an alteration of course, should be substantial. A number of small alterations of speed should be avoided.

The 1960 COLREGS stated that vessels “may take early
and substantial action to avoid a close quarters situation”. It should be noted this regulation was a directory statute. The vessels should take action at mainly “moderate speed” and “stop her engine” in restricted visibility.

2.2 1972 COLREGS

The 1972 COLREGS were composed of the following contents:

- Part A - General (Rule 1 - 3)
- Part B – Steering and sailing rules
- Section I Conduct of vessels in any condition of visibility (Rule 4 - 10)
- Section II Conduct of vessels in sight of one another (Rule 11 - 18)
- Section III Conduct of vessels in restricted visibility (Rule 19)
- Part C - Lights and shapes (Rule 20 - 31)
- Part D - Sound and signals (Rule 32 -37)
- Part E - Exemptions (Rule 38)

The term “restricted visibility” had been explained in Rule 15 (c) in the 1960 COLREGS. On the other hand, the term “restricted visibility” had been explained in Rule 3 (l) in the 1972 COLREGS.

The term “moderate speed” in the 1960 COLREGS Rule 16 (a) had been provided and changed to the wording “safe speed” including RADAR characteristics in the 1972 COLREGS Rule 6. The 1972 GOLREGS had provided “safe speed” explanations in Rules 6 and 19. On the other hand, the Act on preventing Collisions at Sea (Japanese domestic regulation in conformity 1972 COLREGS) had provided information on “safe speed” only in Rule 3.

Cockcroft and Lameijer (2011) summarized Rule 19 (e) as follows; “In restricted visibility, in the open sea, a close quarters situation is generally considered to begin at apply at a distance of at least 2 miles in any direction forward of the beam as this is the typical range of audibility for the whistle of a large vessel in still conditions.” In Japan, Fujimoto (2000) described Rule 19 (e) of the distance as an instance that “Cannot avoid a close quarters situation” was 2.5 nautical miles in direction forward of the beam and 1.5 nautical miles in direction afterward of the beam, except for the harbor area, from the Japan Marine Accident Inquiry written decisions. For the first time, the 1960 COLREGS explained that “action consists of an alteration of course” in restricted visibility. This was a directory statute. It could be regarded as an obligation of the vessel equipped the RADAR.

The 1972 COLREGS provided that “action consists of an alteration of course” as a mandatory statute in restricted visibility. The OOW should followed either Rule 19 (d) or Rule 19 (e). Therefore, the OOW would be forced to make a more difficult decision. Without the time of RADAR...
plotting (plot on the RADAR screen), the OOW can find out an another vessel’s movement very quickly by using by ARPA, AIS and VHF. The authors thought that the OOW would be think the timing of “a close quarters situation” to be similar to the timing listed in the above situation in Rule 19 (d).

3. THE CASE OF COLLISION “ASIA CONCERTO” - “PINEPIER”

As described above, avoiding action regarding the stage of “a close quarters situation” were very differently worded in the 1972 COLREGS. It was very important that the starting point and end point of Rule 19 (d), and the starting point of Rule 19 (e) for the OOW were understood. By analyzing maritime accidents in detail, the authors would find out the criteria of Rule 19 (d) and (e) in the Japan Marine Accident Tribunal.

Therefore the authors investigated the judgments of Marine Accidents Inquiry and Safety Investigation Association from 2006 to 2015. As the results, There were 143 cases that applied Rules 19 (including the decision of the second trial), In above cases, there were 50 cases related with the fishing boats. There were 35 cases related with the collision between the cargo ship. In above cases, there were 31 cases related with less than 500 tons of small ships.

This paper referred to the information from the navigational equipment. Therefore, the authors decided to examine the collision between the vessels equipped same level navigational equipment. The authors picked up collision case between “ASIA CONCERTO” and “PINEPIER”. The reason was that if the visibility was good condition, this collision case applied Rule 14 (hand-on situation).

3.1 The outline of the case

In the Seto Inland Sea, the Pinepier (4,314 gross tonnage, LOA100.5m) sailed eastbound. However, she did not sail along the right side of the recommended route line. Therefore, she collided with the westbound vessel Asia Concerto (4,458 gross tonnage, LOA97.42m). On both vessels, the OOW were chief officers with experience sailing (40 - 50 times in the Seto Inland Sea).

3.1.1 Action of “Asia Concerto”

- The captain had orders to “immediately report to me when visibility conditions became restricted”. “Asia Concerto” sailed course <251>, speed 11.8 knots by hand steering and exhibited the lights prescribed in the 1972 COLREGS.
- 14 minutes 30 seconds before collision
  The OOW was confirmed “Pinepier” on the port bow 2degrees 5.7 nautical miles by RADAR.
  The RADAR set off-center 4 nautical miles afterwards from the center at 6 nautical miles range.
  The OOW ordered, “Stand by engine”.
- 9 minutes 30 seconds before collision
  The OOW was confirmed “Pinepier” on almost right ahead 3.9 nautical miles by RADAR.
  The visibility was around 200m.
- The OOW did not report it the captain.
- And did not reduce speed to “safe speed”.
- Furthermore he did not confirm AIS data.
- The OOW judged passing starboard-to-starboard.
- Therefore, the OOW changed alter course <260> for getting wide room.
- He set the RADAR range 3 nautical miles and plotting “Pinepier” on the RADAR screen.
- 4 minutes 30 seconds before collision
  The OOW was confirmed “Pinepier” on the port bow 1.9 degrees 1.9 nautical miles by naked eye.
  He felt that he could not "avoid a close-quarters situation”
- The OOW thought “we were innocuously passing “Pinepier” due to CPA 0.1 nautical mile. ”
  Therefore, he did not reduce her speed as “Asia Concerto can keep on her course” and if necessary take all her way off.
- 1 minutes 30 seconds before collision
  The OOW was confirmed “Pinepier” on almost the port bow 0.8 nautical miles by naked eye.
  He recognized a “danger of collision “ and ordered “starboard 10”.
- 1 minute before collision
  “Asia Concerto” was blowing “prolonged blast” and took action “hard a starboard”.
- “Asia Concerto” collided with westbound vessel “Pinepier, course <330> speed 11.8 knots.

3.1.2 Action of “Pinepier”

- The captain had ordered crew to “immediately report to me when the visibility is less than 3 nautical miles.
- “Pinepier” sailed actual course <066>, but her gyrocompass had an error. Her gyrocompass indicated her heading course <077>. Her speed was 12.3 knots by autopilot and exhibited the lights prescribed in the 1972 COLREGs.
- The OOW altered course <061> to avoid the fishing boat. He thought, “Pinepier would be sailing along the right side of the recommended route line.”
- 10 minutes 30 seconds before collision
  The OOW did not notice “Pinepier” was sailing along the left side of the recommended route line.
- 9 minutes 30 seconds before collision
  The OOW recognized the visibility was getting worse,
but he did not contact the captain.
He did not carry out “sound signal in restricted visibility” and did not reduce speed to “safe speed”.
The RADAR set off-center 2 nautical miles afterwards from the center at 3 nautical miles range.
Therefore, he did not notice “Asia Concerto”.

➢ 4 minutes 30 seconds before collision
The OOW still did not notice “Asia Concerto”.
He did not reduce her speed as “Asia Concerto can be kept on her course” and if necessary take all her way off.

➢ 1 minute 30 seconds before collision
The OOW was confirmed “Asia Concerto” on the starboard bow 17 degrees 0.8 nautical mile by RADAR.
Furthermore he did not confirmed AIS data.
But he recognized the “risk of collision” due to the approaching situation.

➢ 30 seconds before collision
“Pinepier” was blowing “two short blasts” and took action “hard a port”.

➢ “Pinepier” collided with “Asia Concerto”, her heading course <040> speed 12.3 knot

Fig.1 Collision situation between “Asia Concerto” and “Pinepier” (Source: Hiroshima local marine accident inquiry agency)

3.2 Rule 19 (d) or (e)
In the above accident, the Marine Accident Inquiry did not concretely define the point of “a close quarters situation is developing and/or risk of collision exists (Rule 19 (d))”. The Marine Accident Inquiry presumed the point of “cannot avoid a close quarters situation with another vessel” at 4 minutes and half (distance 1.9 nautical miles) before the collision. As compared to the described opinion of Cockcroft et al. (2011) and Fujimoto (2000), the measures outlined above were the proper course of action.

However, it was a big problem that the OOW of Asia Concerto did not recognize the point of “cannot avoid a close quarters situation with another vessel” at 4 minutes and half (distance 1.9 nautical miles) before the collision, in spite of the OOW observing another vessel on RADAR.

It is not clearly evident if the OOW of the Asia Concerto was able to recognize “the time to take avoiding action consisting of an alteration of course, at 4 minutes and half before the collision,” from the description of the Marine Accident Inquiry. On the other hand, the Marine Accident Inquiry pointed out that “it was only CPA 0.1 nautical mile passing Pinepier, and the OOW of Asia Concerto thought “her course was acceptable passing course.” It was necessary
Fujimoto (2014) pointed out that there was a time lag of much between the approaching two vessels. Therefore, “safe speed” and “risk of collision” did not matter vessel’s ability to maneuver, traffic density and area. Is a “risk of collision” depends on weather conditions, the “how many knots was a safe speed?” and “How many miles visibility” under the above condition.

Small fishing boat operator would not recognize “restricted visibility” if the vessel would recognize that the visibility was restricted, Rule 19 would be applied to the vessel. There was an issue that the recognition of “restricted visibility” did not much between large vessels and/or small boats due to restricted visibility, so the degree of “risk of collision” should have been increased.

Also, there was a wide gap of recognition in not being able to “avoid a close quarters situation” between a large vessel and small boat. The situation of “a close quarters situation” was the timing that there was not enough time for collision avoidance for the other vessel. According to the Japan Marine Accident Inquiry, the above timing had been determined by calculating backward using the shortest stopping distance. The purpose of the legislation Rule 19 (d) was for “the vessel shall take avoiding action for “a close quarters situation” in ample time”. However, the timing of large vessel’s “close quarters situation” was earlier timing than the small boat’s timing. In other words, the timing of “a close quarters situation” was “danger of collision” for large vessels. This explanation describes the actual condition for the above situation.

4. Results and discussion (1972 COLREGS Rule 19)
4.1 The time lags of “risk of collision” between large vessel and small boat

The 1972 COLREGS made changes to rules of visibility conditions. The 1972 COLREGS also did not provide a clearly defined distance for when the visibility condition for the vessel would be applied to Rule 19. When the OOW would recognize that the visibility was restricted, Rule 19 would be applied to the vessel. There was an issue that the recognition of “restricted visibility” did not much between the approaching two vessels. In general, when the visibility would be less than 3 nautical miles, the OOW should call the Captain and add crew for look-out on the vessel. On the other hand, a small fishing boat less than 5 tons could operate in restricted visibility at less than 500m. So, the small fishing boat operator would not recognize “restricted visibility” under the above condition.

The OOW and/or small boat operator would determine “how many knots was a safe speed?” and “How many miles is a “risk of collision”” depends on weather conditions, the vessel’s ability to maneuver, traffic density and area. Therefore, “safe speed” and “risk of collision” did not matter much between the approaching two vessels.

Fujimoto (2014) pointed out that there was a time lag of “risk of collision” between the large vessel and small boat. In restricted visibility, there was the same issue that the time lags create a “risk of collision”. The timing of the large vessel’s “risk of collision” was earlier than the small boat’s timing. In other words, the timing of “risk of collision” was “danger of collision” for large vessels. Furthermore, the OOW and/or small boat operator could not see other vessels and/or small boats due to restricted visibility, so the degree of “risk of collision” should have been increased.

4.2 Rule 18 or Rule 19

The 1972 COLREGS were divided into rules that applied to three types of situations; Rule 13 overtaking, Rule 14 Head-on situation and Rule 15 Crossing situation for vessels in sight of one another. The 1972 COLREGS could have guaranteed the safety of vessel traffic by clearly explaining when vessels should take action in above situations. In restricted visibility, the above three rules would not be applied, and also would not be applied to Rule 18, as all vessels and/or should follow Rule 19. However, there was an issue with the time lags of “risk of collision.” If a small fishing boat was engaged in fishing operations, she would lose the priority of the stand-on vessel (other vessels underway shall keep out of her way) due to the deterioration of visibility conditions. Some small fishing boat operators might be convinced by the application of Rule 18 in restricted visibility. There were 15 of 62 cases total where small fishing boat operators applied Rule 18 in restricted visibility conditions from 2005.1 to 2014.12. 11 of these cases resulted in collisions during fishing operation. The Japan Transport Safety Board reported that some large vessels could not find small fishing boat on RADAR in the case of restricted visibility due to heavy rain. The Japan Transport Safety Board recommended that AIS be installed in small fishing boats in order to rectify the above situation. The Marine Accident Inquiry Agency recommended that VHF be installed in small fishing boats as a communication tool between large vessel and small fishing boats. The authors thought that the installation of AIS for small fishing boat was a good measure to ensure the safety in consideration of operating areas and hours, but it is not
fundamental solution. First, the small fishing boat operators should recognize that it is difficult for large vessels to see small boats in heavy swells, waves and rains. Small fishing boat operators should recognize that small fishing boats would lose priority as a stand-on vessel (other vessels underway shall keep out of her way), even if the small fishing boat would be engaged in fishing operations in restricted visibility. It is important that "each vessel should pay attention to her equivalent" should be made universally known to all small fishing boat operators.

4.3 Rule 13, 14, 15 or Rule 19

Symns (2003) stated that "about 80% of the seafarers did not understand RULE 19" in his report. Salinas (2006) carried out a test with professional seafarers of different training and experience backgrounds, ranging from masters and pilots to officers with one or two years’ experience at sea. In the test, One ship sails in restricted visibility conditions of 3 cables, as a close quarters situation is develops with another vessel. He said as a result; "to the targets approaching from port, 82% of subjects interviewed answered that at first they kept course and speed; this option increases to 93% when the other vessel is approaching from starboard or port quarter. In other words, most of them really think they are either in a crossing or overtaking situation, where it is the other vessel that must undertake the manoeuvre." 15)

The authors thought that the OOW would misapply Rules 13, 14 and 15 in restricted visibility, rather than misunderstanding Rule 19, because they had a superficial understanding of "restricted visibility condition."

According to KAINANBUNSEKISHU from 2001 to 2005, there were 91 collision cases (157 vessels) in relation to cargo vessels, tankers and passenger ships in restricted visibility. In the above cases, there were 74 vessels (47%) that she could not avoid a close quarters situation, but did not reduce speed and stop. The reasons were as follows;

"The CPA was close, but the OOW thought own vessel was able to pass."

"When the OOW found the another vessel by naked eye, own vessel could take avoiding action."

"The OOW thought another vessel might take avoiding action."

"The OOW thought own vessel could make acceptable safety passing distance by altering course by a small angle."

Marine Accident inquiry Agency’s analysis was shown as follows;

"own vessel altered course to starboard for port to port passing, but other vessel altered course to port."

"The OOW predicted other vessel’s course, but it was thwarted in OOW’s plan."

In other words, the OOW should understand the trend of other vessel from RADAR, etc., and take action as outlined in Rules 13, 14 and 15, trusting other vessels to take same action. However, the OOW predicted the movement of other ships differently from their actual movement, which led to the collisions.

The OOW would use the same navigational equipment, have the same procedures, and make correct maneuvering decisions in good and poor visibility.

Salinas (2006) said that in “good and poor visibility, the screen display is practically the same. So the OOW is again in front of a screen which shows echoes, sometimes crossing, overtaking, or head-on, and he instinctively wonders why not to use the head-on, crossing and overtaking rules that produce quite accurate results. To the contrary of what must it is stated in Paragraph (d) of Rule 19, where instead of saying positively what must be done, it is stated what must be avoided.” 17)

4.4 Developing navigational instruments and the abilities of the OOW

Okada et al. (2015) pointed out “information related to navigation would increase due to the development of navigational equipment. In order to manage their various information cleverly, the new capabilities would be required from the OOW. ” They said “ proper use ” of information from the navigational equipment were “not to have overconfidence,” “operate the navigational equipment on a case-by-case basis” and “choose information which was relevant for safe navigation.” In other words, just “using information from the navigational equipment” would not equal “safe, accident-free navigation” 18)

Fuchi et al. (2015) pointed out “there were some seafarers who could not effective use of information from navigational equipment”. 19)

In The case of collision “ASIA CONCERTO” - “PINEPIER”, the OOW of Asia Concerto had captured the Painpier by the ARPA. He was receiving detailed information of CPA 0.1 nautical miles. Nevertheless, in restricted visibility, He thought his own vessel could make an acceptable pass at a safe distance. This miscalculation had grave consequences. It was very important to determine detailed information from navigational equipment from the abilities of the OOW.

5. CONCLUSION

Rule 5 "Look-out", in Section I "Conduct of Vessels in any Condition of Visibility" of Part B " Steering and Sailing rules" in the 1972 COLREGS provided that every
vessel shall at all times maintain a proper look-out by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

In good visibility, the Rule should be required at all times to maintain a proper look-out by using navigational equipment with a proper look-out by naked eye.

In restricted visibility, the OOW should determine if a close quarters situation is developing and/or risk of collision. If so, he or she should take avoiding action. In the above situation, he or she would determine the “risk of collision” by using navigational equipment such as RADAR, ARPA, AIS, VHF, etc. The use of this navigational equipment is strongly recommended; with “the proper use of all navigational equipment, accidents are prevented.” However, the authors wonder if accidents would decrease significantly by outfitting navigational equipment as much as possible in all ships. In the current situation, all kinds of ships were not set up with various navigational equipment. So, it would be impossible to share the same information with all kinds of ships in the same sea area.

Furthermore, the OOW should determine whether a situation calls for “innocuously passing” or is a potential “collision situation” by using the detailed numerical information from the navigational equipment as stated 4.3.

The 1972 COLREGS were not detailed in numerical data; rather it provided a code of conduct in accordance with the situation. On the other hand, the effective use of navigational equipment requires the application of detailed numerical data. Such a contradictory situation perpetuates with it a paradox of great danger.

In order to solve the issue inherent in Article 19, Salinas (2006) made a partial amendment with Article 19 (d) 21); Weber (1995) also made a partial amendment with Article 19 (e) 22). The above amendments could be expected to improve under the situation that were not addressed in great revision of the 1972 COLREGS.

On the other hand, the issue of Article 19 pointed out in this paper illustrates an essential difference between COLREGS and the detailed numerical data from navigational equipment rather than being generated from “Article 19 legislation on the deficiencies”. Therefore, even if the above amendments catalyzed some of the intended effects, the “Article 19 amendments” and “understanding promotion for seafarers” would not fundamentally solve all of the problems inherent in Article 19.

The authors make the following proposal in regard to this issue;

- In restricted visibility, the OOW should determine maneuvering actions by paying more concentrated attention than in good visibility conditions.
- The OOW should always be aware of small fishing boats that might be difficult to capture by RADAR.
- The OOW should not accept information from navigational equipment without double-checking.

Once again, we should go back to the observance of good seamanship which was the principle of the COLREGS. And the authors consider the solution for achieving the integrity of the on scene site and the COLREGS to be effectively by using detailed and accurate information from navigational equipment for increased safety.

In the near future, unmanned ships will appear with new technology and new autopilot logic that analyzes the stored maneuvering data from AIS and other navigational equipment. There have already been discussions on whether maneuvering actions should be determined by “the OOW” or “the computer machine.” In addition, discussions concerning whether “the OOW” or “the manufacturer” should hold ultimate responsibility have begun.

44 years have passed since the creation of the 1972 CORLEGs. When fully-automated vessels come into service, we should create new rules on a realistic basis after analyzing large amounts of data. As a response to new circumstances, the 1972 CORLEGs should be changed. We should create rules not only on the state of visibility, but also based on navigational instrument information. However, the authors admit that it would be difficult to change the 1972 CORLEGs due to international rules.

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9. A U T H O R ’ S B I O G R A P H Y
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