A Review of the current Collision Regulations to accommodate Multiple Ship Situations and MASS

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Abstract The age of sailing ships and primitive tools has evolved into one of power-driven vessels with sophisticated equipment that can substitute the navigating navigator with a monitoring navigator or remove the human onboard. The technology exists but in order to embrace it to bring about safer seas, current legislation and practices need to be reviewed to provide comfort and clarity for dynamic transformation to take place. This paper provides a comprehensive study of the current collision regulations and humbly suggests some revisions to ensure safe intelligent navigation. Collision avoidance is not about a ship meeting another ship with the actions regulated. Realistically, the navigator is faced with a multitude of ships and situations where the risk of collision may exist with several vessels needing to take avoiding action or requiring to maintain course and speed as dictated by the current rules. SMART technology can provide speedy and reliable computed actions to assist the navigator, reducing human error or the widely differing actions that might be taken by individual humans. Ultimately, unmanned ships may be the future of shipping as eradicating human error is only possible if the human is removed. Collating measurable effective actions from reputed ship masters for a multitude of collision scenarios and programming them into an artificial intelligence system, will provide stable and predictable collision avoidance actions that can be shared on inclusive platforms with other ships in the vicinity. This removes the varied action of humans and synchronizes manned vessels with MASS providing accurate predictive movements and big data computation. It is timely that the current collision regulations are reviewed and complications addressed to render clarity and simplicity with MASS treated no different. As we harmonize technology and humans with a defined regulatory framework that embraces both, only then can the desired goals become a reality.

1 Introduction
The age of men on wooden ships is a distant memory. Whilst many may remark that it is now about wooden men on steel ships, I would find it difficult to agree. With gloomy statistics on maritime collisions usually pointing to the human onboard, perhaps fairness would highlight the number of near miss incidents that would have been another statistic if not for the intervention of the navigator (human on the bridge).
The rapid advancement of technology and continued research is sometimes frustrated by legislations that hinders and takes precious time to deliberate, leaving seaworthiness in a precarious position. The multitude of debates on whether the world is ready for MASS [1] and its legal implications should not be the issue. MASS is not a game-changer but a catalyst to embrace technology to substantially improve situational awareness and significantly reduce collisions and other maritime disasters.

Autonomous ships can dynamically interact with manned ships. The dire concern is to plug the gap on human error. It will provide dynamic determinations especially in complicated multiple ship situations where the human mind varies in interpretation and avoiding action. AI (artificial intelligence) integration would shore up cognitive tunnelling and other human limitations so often exposed and propagate a stable and consistent action that is pre-determined and ‘communicated’ to surrounding vessels. Embodying such technology would eradicate the differing human analysis and action yet not replace or override the human. The AI algorithms incorporated in the system is isolated from human distractions, stress and fatigue which are culpable elements in collisions. As for the ever-increasing fear of cyber-attacks, cyber resilience ensures technology is coupled with actionable intelligence that also enables human intervention and other fail-to-safe or manual override to address concerns when automation gets corrupted.

Enhancing the safety of navigation with technology is not an option but an urgent necessity. The advancement in smart sensors and automation systems coupled with AI is not (yet) to replace the navigator but transform the operations of a ship from a ‘navigating navigator to a monitoring navigator’. These analytical tools that mimic human learning algorithms from data analytics is not affected by the ever changing environment that affects a human’s situational attention but has the privilege of being programmed with the competence of the best navigators, past and present and has a self and continued deep learning algorithm.

2 Regulatory Structure & Concerns
The regulatory framework covers an extensive range of laws that govern the operation of ships and includes different legal systems that range from national laws to international laws. There is also public concern as well as civil law matters such as contracts of carriage, marine risks and pollution, limitation of liability and marine insurance. Whilst the current legislative instruments do not take into account the operations of MASS controlled by an SBO (shore-based operator) or pre-programmed, in reality the fundamental difference is the presence of the master onboard executing real time and on-the-spot decision making. Hence, the seaworthiness of such vessels from a legal perspective may be in question when the vessel is not physically commanded onboard. It really does not matter as it is the ship owner and not his servant (ship’s master) who has the liability and is answerable.

This paper provides a review of the current collision regulations [2] that was adopted in 1972 and given statutory force of law with the primary objective to prevent collisions. Statistics in the last forty years did not signify a positive effect. Whilst the emergence of MASS is not a panacea for eradicating collisions, nonetheless it is the right step forward in enhancing the safety of navigation by incorporating the available technology. The final part of the equation would be the need to amend the current collision rules to accommodate the future-ready navigator embracing an AI (artificial intelligence) navigation system with deep learning algorithms. Perhaps with that, we will achieve the desired goal!

3 Research & Analysis
The review is based on both qualitative and quantitative research with some theoretical analysis. It is not just meaningful but timely. In essence, it may not be bold nor reckless to declare that autonomous ships can co-exist with manned ships under the current 1972 collision regulations. However, the weak link is not just the human factor but perhaps that the current collision
regulations should be clarified, simplified and aligned with current supportive and dynamic technology that must be used to reduce collisions and other maritime accidents.

The findings and suggestions are being trial tested and supplemented with a research simulator to enable effective and relevant application for multiple ship interactions in close proximity and near vicinity with anti-collision engagements of different categories. The test bed will provide a comprehensive understanding of varying circumstances and conditions that would benefit ship owners, charterers, insurance companies and P&I Clubs (not forgetting Flag state, Port state and Coastal State concerns and jurisdictions). Most importantly, to save lives, protect our marine environment and preserve maritime property.

The Rules [1] being analysed are:
- Rule 1: Application
- Rule 2: Responsibility
- Rule 3: General Definitions
- Rule 5: Look-out (Conduct of vessels in any condition of visibility)
- Rule 6: Safe speed
- Rule 7: Risk of Collision
- Rule 8: Action to Avoid Collision
- Rule 9: Narrow Channels
- Rule 10: Traffic Separation Schemes
- Rule 11: Application (in sight of one another)
- Rule 13: Overtaking
- Rule 14: Head-on Situation
- Rule 15: Crossing Situation
- Rule 16: Action by Give-way Vessel
- Rule 17: Action by Stand-on Vessel
- Rule 18: Responsibilities between Vessels
- Rule 19: Restricted Visibility
- Rule 34: Manoeuvring and Warning Signals
- Rule 35: Sound Signals in Restricted Visibility
- Rule 36: Signals to Attract Attention

In reviewing the collision regulations, there were more than a few passionate discussions with ship masters, deck officers, cadets and DPAs (designated persons ashore). Varied interpretations surfaced on the rules and diverse actions that should or is actually taken. It also focused on the ambiguity and uncertainty in distinguishing the application in restricted visibility, clear visibility and when navigating near an area of restricted visibility.

There is a need for consistency in the interpretation and application of the rules with clarity when the customary practice of seafarers makes it a need to depart from the rules to avoid immediate danger. Perhaps confusion and contradiction could be arrested with the use of artificial intelligence. It would propagate a common action that would also be pre-determined and known to the other party by way of developed technology incorporated in basic navigational equipment or supplemented. This is the way forward to ensure that differing human perception and analysis in propagating a crucial action is effective and not a contributing factor that lead to the collision.

To provide a simplified review, the analysis would be grouped into key segments covering several relevant and associated rules.

These would be:
3.1 Multiple ship situation
3.2 Application on Visibility – Rules 4, 11 & 19
3.3 Responsibilities – Rule 2
3.4 General Definitions – Rule 3
3.5 Look-out- Rule 5
3.6 Safe Speed – Rule 6
3.7 Risk of Collision – Rule 7
3.8 Action to Avoid Collision – rules 8, 13, 14, 15 16 & 17
3.9 Narrow Channels and TSS – Rules 9 & 10
3.10 Responsibilities between Vessels – Rule 18
3.11 Manoeuvring and Warning Signals – Rules 34, 35 & 36

3.1 Multiple ship situation - clear visibility (Power driven vessels)

Figure 1: Scenario is seven ships plus a naval patrol craft in the vicinity

Overtaking Own ship and A give-way to each other (R14);
Own ship to give-way to E and F (R15); and
Own ship to stand-on for B (R15), C & D (R13).
What about A in relation to B, C, D, E & F?
What about C in relation to A, B, D, E & F? … and the others?

3.2 Application on Visibility – Rules 4, 11 & 19
There are three rules on visibility listed in three sections with key differing aspects of collision avoidance as regulated by the current COLREGs. A vessel thus executes the rules based on the current condition of visibility and need to be certain when navigating near an area of restricted visibility whereby there are vessels in sight of one another and several others in the area of restricted visibility and then in clear visibility. Does it then put one vessel on the need to engage rule 11 whilst the other vessel follows rule 19?

With several vessels in the vicinity, again there is an application of the rules that would require varying actions. Imagine as well when some vessels are also sounding their fog horn and whistle. Is this really helpful? Sounds being emitted is not easily distinguished by the human senses and the
direction where it is coming from. Could the distance be determined by sound? Considering the fact that aircrafts and automobiles do not distinguish between restricted visibility or otherwise, would not a single environment media be sufficient for vessels? The available technology (already used by some ship owners) to complement the human onboard with such dynamic and accurate decision support systems (including autonomous systems) operate on a single environment media. It is thus strongly suggested to reconsider the current rules on visibility as it does not matter if the visibility is clear or restricted and other conditions encountered or going to encounter but does matter if the human onboard is uncertain which to apply and how conditions can change.

The 3 relevant rules are:
- R 4: Apply in any condition of visibility;
- R 11: Vessel in sight of on another; and
- R 19: Conduct of vessel in restricted visibility

3.3 Responsibility – Rule 2
It indicates that ‘nothing in the Rules shall exonerate any vessel, or the owner, master or crew thereof, from the consequences of any neglect’ to comply and links it with the ‘ordinary practice of seamen’. The other part speaks of ‘all dangers of navigation and collision and to any special circumstances, including limitations of the vessels involved, which may make a departure from these Rules necessary to avoid immediate danger’.

This creates a very challenging situation for the navigator as the rule is not aimed at permitting a departure from the rules but to emphasize to the navigator that there may be times when the special circumstances including the limitations of the vessels involved, would make it necessary to facilitate an action differently. However, in a multiple ship situation, whilst one may be abiding by the rule, it may necessitate a departure from the rules in the same situation but with another vessel. Remember that following the rules does not exonerate the navigator should a collision occur. The responsibility for action and precautionary measures may be interlinked with regard to the ordinary practice of seamanship or by special circumstances of the case and perhaps also the prevailing or changing conditions.

3.4 General Definitions – Rule 3
Definitions are crucial and most helpful, and was last updated when the WIG (wing-in-ground) craft emerged. It brought about clarity. Likewise for MASS (maritime autonomous surface ship), there is a need to insert the definition as R3(n) and also consider related terms like the SBO (Shore based operator).

Do note that R3(f) and R3(g) are with reference to a ‘vessel that is not under command’ (NUC) and a “vessel restricted in her ability to manoeuvre” (RAM). The principle element is that both vessels are unable to manoeuvre as required by these Rules and are therefore unable to keep out of the way of another vessel. This is emphasized as there are more than a few who would declare that a RAM vessel is to give-way to a NUC vessel. This has to be corrected.

Whilst an NUC vessel may need time to rectify the situation and revert back to normal status, for a RAM vessel, the nature of the work should be in relation to the circumstances and conditions and proximity of other vessels so that there is an avenue to be able to keep out of the way of other vessels by stopping or suspending work.

3.5 Look-out – Rule 5
The past and current role of the look-out with the judicial interpretation, ‘sight and hearing’ relates to a physical presence on the bridge. However, given that available technology is not primitive in comparison with the 1970s, the term look-out should no longer be limited to a physical means.

Whilst this rule is short, note the sentence ‘and by all available means appropriate in the prevailing circumstances and conditions’. It indicates that one is required to use all available
means and not just one or two appropriate means. Using one’s eyes may be enhanced with binoculars but by hearing (ears) is rather challenging as what sound and where it is emitted and how far away, is most difficult to ascertain conclusively. It would not be easy to find a navigator who would positively declare that hearing the fog horn of a vessel would provide sufficient data needed to take avoiding action. As for conditions, in restricted visibility, the physical sight and hearing would not be useful (as it would already be too close) but necessitate the use of radar and other dynamic means available and fitted onboard.

Findings have shown that most collisions and groundings were the result of the incorrect interpretation of this rule or not applying it sufficiently. It would thus be foolish not to make use of radars, ARPA, aural sensors, AIS, AI and other ‘look-out’ technology. More importantly, the human mind is at a disadvantage when there are several ships around where there exist multiple close-quarters situations. As such, technology for MASS, should be considered for manned ships. It would greatly assist in multiple ship scenarios and as ship owners and navigators get to understand its application better, it would become an integral part of essential equipment. Coupled with AI, it provides a whole new dimension for a look-out and can do much more yet have no stress nor pressure from appraising the circumstances almost instantaneously and the constantly changing conditions.

As illustrated in para 3.2 (multiple ship situation), facilitating the current COLREGs can be contradicting where rules 13, 14 & 15 dictates application. It is not just a complicated but contradicting situation with complexities that is a situational dilemma requiring more than just academic understanding and a departure from the rules to avoid immediate danger and ensuring it does not result in another close-quarters situation.

3.6 Safe speed – Rule 6
Safe speed is relative and ‘every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped at a distance appropriate to the prevailing circumstances and conditions’. However, safe speed varies as it is in relation to the stopping distance based on the range of visibility and the proximity and extend of dangers to navigation. It is generalized but the judicial interpretation is indicative that safe speed is based on the speed through water and not the engine speed. More so, the safe speed in restricted visibility cannot exceed the full manoeuvring speed as it is only in this mode that the speed can be adjusted.

In many follow up investigations after a collision, excessive speed was held causative both in terms of being able to use the speed for collision avoidance and/or the time frame allowed to assess the situation and take avoiding action. In essence, it is also having sufficient or creating sufficient time by way of reducing the speed to provide more time to assess the situation and be cautious of the causative potency that results in a collision. However, a safe speed may also be the steerage speed as reducing the speed below that would mean that the ship is unable to manoeuvre (steer) and therefore unable to take action if needed (to avoid collision or alter course as per the passage plan and chart).

3.7 Risk of Collision – Rule 7
The risk of collision cannot simply be assessed by current conventional means even if there are just two ships on the horizon in sight of one another. In most collisions, fault arrowed the less than satisfactory human judgement or the confused judgment in taking action.

In order to ‘use all available means appropriate to the prevailing circumstances’, predictive technology should be embraced as multiple ship situations in close quarters are very complex and any vessel altering course or adjusting speed would have a corresponding effect on the CPA (closest point of approach) and TCPA (time of closest point of approach) and of the risk of collision. The rules also say that ‘if there is any doubt such risks shall be deemed to exist’. So it is a yes when there is a maybe? Is it a default or reluctant confusion?

Utilizing AI to predict if a risk of collision will develop and continually monitoring the course
and speed of other vessels in the vicinity and when they are likely to alter course (according to the passage plan and not necessarily for collision avoidance) provides such collision algorithms to be worth their weight in gold and would be considered as the ‘use of all available means’. There is a significant difference for small vessels as opposed to very large ships that are sluggish or require more depth of water and manoeuvring space.

3.8 Action to Avoid Collision – Rules 8, 13, 14, 15, 16 17
The action taken must ‘be positive, made in ample time and with the observance of good seamanship’. The six related rules demands that ‘if the circumstances of the case admit, be large enough to be readily apparent to another vessel observing visually or by radar; a succession of small alterations of course and/or speed should be avoided’.

In reality, a bold alteration of course would heel the ship, reduce her speed and increase the engine load momentarily. This would upset the ship’s master and engineer so preventive actions need to be reasonable to be acceptable. Making a bold alteration would also take the vessel away from her planned track and may create another close-quarters situation with other ships. In reality, many would make a succession of small alterations of course using the auto-pilot system unless in close proximity with other vessels. This is reasonable and in line with the ordinary practise of seamen.

Rule 8(e) states that ‘if necessary to avoid collision or allow more time to assess the situation, a vessel shall slacken her speed or take all way off by stopping or reversing her means of propulsion’. The use of the engines to slow down a ship or take all way off, may not be ideal even though it would provide more time to assess the situation. If early detection and monitoring is carried out effectively, this situation should not happen. Once a ship’s speed falls below 5 knots, she will lose her steerage and if she takes all way off or reverses her propulsion, it is more like making an emergency stop to prevent or minimize an undesirable situation which is an emergency. With AI coupled with MASS technology, early detection is possible.

Rule 8(f) is not about giving-way or standing-on but the ‘not to impede the passage or safe passage of another vessel’. It was initially conceived because of smaller vessels (vessels less than 20m in length, sailing vessels and vessels engaged in fishing) which are more manoeuvrable yet have the right of way under rule 18. However, there were some who felt it was only in narrow channels and TSS but others who insisted that it is applicable in other areas as well. As merchant ships increase in size, it would be rather mischievous for a 10m fishing boat to cross ahead of a 350m tanker and where there is a risk of collision, the huge tanker is required to take action even though it would be safer and easier for the much smaller vessel to keep clear.

Looking at rule 8(f)(i), ‘not to impede the passage or safe passage of another vessel shall, when required by the circumstances of the case, take early action to allow sufficient sea room for the safe passage of the other vessel’. It is not easy for the navigator to pre-empt such a situation and there has been cases of early action taken that resulted in a collision but if no early action was taken, both vessels passed clear.

Rule 8(f)(ii) reminds that the ‘vessel required not to impede the passage of another vessel is not relieved of this obligation if approaching the other vessel so as to involved risk of collision and shall, when taking action, have full regard to the action which may be required’. This means that if the vessel that is required to take early action but does not do so and a risk of collision exists, the other vessel whose passage is impeded, is required to take action as per the rules (R18), yet examining R8(f)(iii) which regulates that ‘a vessel the passage of which is not to impede remains fully obliged to comply with the Rules of this Part when the two vessels are approaching one another so as to involve risk of collision’. It becomes a little Shakespearian whereby one needs to decide, ‘to do or not to do?’

Examining R13, a vessel overtaking another can also be a vessel not under command (through some exceptional circumstances is unable to manoeuvre as required by these Rules and is therefore
unable to keep out of the way of another vessel). The rule requires that ‘any vessel overtaking any other shall keep out of the way of the vessel being overtaken’. This is also applicable to the RAM vessel but similar to the NUC vessel, according to the rules, both are unable to keep out of the way of another vessel. What then is the solution or action required? A departure from the rules necessary to avoid immediate danger?

3.9 Narrow Channels and TSS – Rules 9 & 10
‘A vessel proceeding along the course of a narrow channel or fairway, shall keep as near to the outer limit of the channel or fairway which lies on her starboard side as is safe and practicable.’ However, how does one ascertain on how safe and practicable and does it mean that it is good seamanship to pass each other port to port? How if there are other vessels in the vicinity as well and the circumstances make it risky to do this.

What is visibly noticed is the term ‘shall not impede the passage of a vessel which can safely navigate only within a narrow channel or fairway’. It is applicable to vessel less than 20m or a sailing vessel R9(b) and R9(c) vessel engaged in fishing when in a narrow channel and TSS (traffic separation scheme). There is better clarity than analyzed in C9.

Viewing the TSS, it came about to enhance the safety of passage, separating opposite flows of traffic in areas where there is heavy traffic and when ships may converge causing a bottleneck (entering a narrow channel, picking up pilot, etc). Thus in a TSS (R10), it states that ‘a vessel engaged in fishing shall not impede the passage of any vessels following a traffic lane’ and that ‘a vessel of less than 20m in length or a sailing vessel shall not impede the safe passage of a power-driven vessel following a traffic lane’.

With all due respect and also what was outlined in C9, perhaps the term ‘not to impede’ may not be a conducive term to denote the need to take ‘early avoiding action’ as it is to be executed before there is a risk of collision but one in which early action is to be taken to allow sufficient sea room for the safe passage of another vessel. Clarity, confusion or contradiction?

It is thus proposed that the need to not impede the safe navigation and being able to apply this term in the Rules, would be a wise choice to have it removed. Instead, we could consider, ‘vessels less than 20m or a sailing vessel or a vessel engaged in fishing vessel in a narrow channel and TSS, shall keep clear of all other ships. As there is still the question between a vessel less than 20m and a sailing vessel, the vessel less than 20m (whether it is a power-driven vessel or under oars), is to give way to a sailing vessel and a vessel engaged in fishing. Needless to say, under R18, a sailing vessel shall give way to a vessel engaged in fishing.

3.10 Responsibilities between Vessels – Rule 18
The key purpose of this Rule is to designate the vessel with no restrictions or complications i.e. most manoeuvrable to keep out of the way of other vessels (which are described based on type or restriction in manoeuvrability). It thus provides different levels of giving-way. There has been suggestions that a MASS could be a NUC or RAM vessel. I do not share this suggestion. A MASS should be considered as a power-driven vessel, thus categorised with a manned power-driven vessel. Perhaps, considering the fact that when MASS start to trade, with their AI autonomous technology, are unrestricted and have an enhanced situational awareness and anti-collision algorithms in-build with fail to safe features.

Do note that this Rule is under Section II – Conduct of vessels in sight of one another. Thus it is not ‘in any condition of visibility’ though being is sight of one another and restricted visibility is part of any condition of visibility. For this reason, it is suggested that we do not differentiate between restricted visibility and when vessels are in sight of one another as that has caused confusion in the past on application of the Rules.

What is interesting to some but to others perhaps, is that it states who shall keep out of the way except where Rules 9, 10 and 13 otherwise require. This means that these three rules over-ride the types of vessels or the circumstances of the case.
It should also be noted that under this Rule, *a vessel constrained by her draft does not have the right of way over a NUC or RAM vessel but all over vessels shall if the circumstances of the case admit, avoid impeding the safe passage of a vessel constrained by her draft*.’

The last addition to this rule is that a WIG craft when taking off, landing and in flight near the surface, shall keep well clear of all other vessels and avoid impeding their navigation. I wonder how a WIG craft when gathering speed to take off, would be able to take avoiding action at that stage? If there were such cases that surfaced, the judicial interpretation would provide some clarity on this.

3.11 Manoeuvring and Warning Sound Signals – Rules 34, 35 & 36

Rule 34 provides manoeuvring and warning signals to be sounded when vessels are in sight of one another. It can be supplemented with light signals. Rule 35 are for sound signals when the vessel is ‘*in or near an area of restricted visibility, whether by day or night, the signals prescribed*…’ Rule 36 are signals to attract attention but cannot be mistaken for any signal authorised elsewhere in these Rules.

In all honesty, these signals when sounded would be heard by those onboard, but for vessels in the vicinity, if or when distinguishable by ships sufficiently close, may not be helpful in the decision making for collision avoidance. Situational awareness and determination of action to be taken to avoid collision should have been decided much earlier with the use of other available means.

4 Conclusions

4.1 Considerations

a. Decision support systems with AI (predictive actionable intelligence) would be workable on both manned and unmanned ships. Current systems have deep and reinforced learning algorithms that can supplement or replace the navigator.

b. For the conduct of vessels under conditions of varying visibility, perhaps there should only be one media i.e. in any condition of visibility.

c. The term “not to impede” has been cause for concern and confusion. Perhaps, it should be removed and the Rules should only have either give-way or stand-on.

d. Manoeuvring signals – whilst lights may be beneficial, sound signals if distinguishable in sufficient time, may still not enhance situational awareness and provide anti-collision guidance. Perhaps, for vessels in close proximity in a harbour or waterway, it may be useful but for the high seas and in waters connected therewith, we should re-evaluate.

4.2 Moving Forward

a. The digital age of autonomous systems surfaced some time ago but apprehension in the maritime industry has kept it at bay. Driverless cars and trains are in existence and aviation had embraced it as well but autonomous does not have to mean a pilotless aircraft. Far from it, the human element is a key principle of the safety landscape.

b. The seafarer (navigator) is still the most important element for the safe and secure running of a ship. The future-ready seafarer cannot remain contented with operational basics but has to be techno savy where brilliant basics is integrating with all available technology to bring about AI situational awareness and support autonomous systems.

c. The IMO course model on BRM (Maritime Crew Resource Management) should include AI integration with the navigator, whether on the bridge, other locations on the ship, ashore or pre-programmed. The future-ready navigator must be competent in managing such technology and systems and be competent with cooperative and non-cooperative ship interactions in port waters and on the high seas.

d. The waterways will get more congested. Ships will increase in numbers and sizes resulting in more multiple ship situations. The maritime industry cannot afford to be left behind or move at a snail’s pace. The IMO and CMI can be the catalyst to bring about focus and real application to make things happen sooner than later.
References

[1] IMO 1972, The International Regulations for Preventing Collisions at Sea (COLREGS), as amended.

[2] Singapore 1992, Merchant Shipping Act (Chapter 179, Section 208) Merchant Shipping (Prevention of Collisions at Sea) Regulations Revised Edition 1990 (25th March 1992) – Singapore’s equivalent for the COLREGS 1972