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AIS and Collision Avoidance – a Sense of Déjà Vu

I. P. A. Stitt

(Email: iain.stitt@btinternet.com)

Although AIS is already in use in a range of vessels, there has been little public discussion on how AIS should interact with the COLREGS in practice. The objective of this paper is to make a contribution to that debate, while recognising that "best practice" will evolve as more practical experience is obtained. The paper suggests the approach that should be adopted in several areas, but concludes that, overall, AIS is nothing more than one of several tools that should enable mariners to fulfil their existing obligations under the COLREGS.

KEY WORDS

1. AIS. 2. COLREGS. 3. Collision avoidance.

1. INTRODUCTION. The AIS (Automatic Identification System) concept has been around for a long time. Consideration of a ship-to-ship identification system was under discussion fifty years ago.[1] Its use for radar surveillance generally and for VTS in particular has been recognised for even longer. The original IMO timetable[2] rightly allowed a considerable period for the fitting (and retro-fitting) of AIS equipment. Not only would this phased approach have allowed manufacturers

time to develop and produce appropriate equipment, but it would also have given a reasonable amount of time for the proper training of watchkeeping officers in the use of that equipment, based on ever-increasing practical experience. The events of "9/11" changed all that. As a result, the timescale has been curtailed. Virtually all commercial vessels must now be fitted with AIS by the end of 2004.

Despite the plethora of general comments about the use of AIS in an anti-collision role, there has been little by way of practical guidance on how it should be used for that purpose. In particular, there has been no public discussion on how AIS interacts with the COLREGS[3] (hereafter referred to as "the Rules"). The objective of this paper is to stimulate that debate by reviewing several of the Rules, while recognising that what amounts to "best practice" will need to be refined as practical experience increases and hardware and software develop further. The Nautical Institute's recent study[4] provides a very timely and sobering reminder that a range of problems and misunderstandings already exist with regard to the Rules, even before the integration of AIS adds further complications.

2. A SENSE OF DÉJÀ VU? Senior mariners will no doubt feel a sense of déjà vu. There are a number of similarities between the introduction of AIS and the period when radar, and later ARPA, were first widely used:

a. The information provided by the system **ought** to be extremely valuable to OOWs.
b. New technology is involved, and the related equipment is being brought into use with only limited experience of the practical effects of that technology. Simulators will be a great help but are no substitute for full operating conditions.
c. Like the initial radar sets, some AIS equipment is not particularly user friendly. The abridged timetable means that first generation equipment, usually in the form of Minimum Keyboard Displays (MKD), will be around for many years. Many ship-owners are unlikely to be willing to upgrade their equipment until forced to do so.[5]
d. It will take time to develop techniques for using effectively the information available from AIS, particularly where only a MKD is fitted and AIS is not integrated into the ARPA or ECDIS. Available evidence suggests that the majority of AIS displays will be non-integrated MKDs[6] – that being the cheapest option.
e. In many cases, watchkeepers will not be properly trained in the use of the equipment and its potential benefits and shortcomings. It is probable that, initially, many of the shortcomings of AIS will not be properly appreciated. Moreover, because of the increased emphasis now being placed on anti-terrorist and ship-to-shore applications, there is a danger that the operational requirements of these applications will form a substantial part of the syllabus, to the detriment of training in the effective use of AIS for collision avoidance.
f. Because different manufacturers will have different "bells and whistles" on their equipment, a significant part of any training appears likely to have to be devoted to how to use a particular set, whereas that time could be better spent on techniques and procedures for using the information that AIS can provide to avoid collisions.

g. The Rules currently make no reference to AIS and the use of AIS information. As with developments in the use of radar, it is likely to be several years before any modifications, specifically to include AIS, are made to the Rules. In the interim, mariners will have to make their own interpretations. The Nautical Institute survey[4] gives a hint of how dangerous that could prove to be.

It is essential that the lessons learned the hard way when radar and ARPA were first used are not forgotten. In particular, AIS-aided collisions must be avoided.

3. AIS AND RULE 2. It is arguable that if a vessel fitted with AIS puts to sea with one or more watchkeepers who have not been fully trained in the **effective** use of the equipment generally as well as the specific set fitted in that vessel, then there is negligence and a breach of good seamanship within the terms of Rule 2. Indeed, it is very possible that fitting AIS gives rise to additional responsibilities. Mr Justice Willmer (as he then was), a very distinguished Admiralty Court judge who personally sat in judgement on well over 100 collision cases, took this position in relation to radar in 1956:

> "The possession of this radar equipment gives the *Westerdam* a great advantage over other vessels which are not similarly equipped; but it brings with it, in my judgement, a concurrent duty to see that intelligent and reasonable use is made of the equipment provided. If she makes a mistake, being so much better equipped than the *Nora*, so much the less does she have an excuse for doing so."[7]

It is reasonable to assume that the same principle would apply to AIS, regardless of whether the equipment fitted is fully integrated with ARPA (or ECDIS), is a MKD, or is a class B set fitted in a fishing vessel or leisure craft.

4. AIS IS NO PANACEA. In these days of "spin" and marketing hyperbole, there is a risk that the shortcomings of AIS will receive insufficient attention. Hence the need to emphasise, particularly in relation to the Rules, that AIS is merely a tool – one of several. At its heart is GPS, which has its own potential for errors and interference, whether by accident, solar events, or design. AIS is fallible. It produces information based on a number of sensors. Some of the information it broadcasts has to be input manually. The recipient of the information has no opportunity to check the integrity of that information and the sensors on which it is based. Accordingly, it is essential that AIS information be crosschecked with information from other sources, such as radar, ARPA and visual observations.

Some AIS equipment may be programmed to present potential solutions to collision avoidance problems. Watchkeepers must not assume that the solutions proposed by the AIS equipment are necessarily accurate or correct. The words of Willmer, J., in another 1956 case, are as relevant to AIS as they were to radar.

> "It has been said more than once that radar, like any other of these scientific instruments with which modern ships are supplied, is an aid to navigation, and is to be treated as such. It is not to be taken as a substitute for navigation in accordance with the Regulations."[8]

5. AIS AS AN AID TO COLLISION AVOIDANCE. As with radar and ARPA, AIS can provide watchkeepers with data that is potentially extremely

LAT: 51° 12.400′ N		LON: 001° 44.250′ E		Nov 24 2003
Heading: 221°	COG: 221.0°	SOG: 16.1 kn		UTC: 11:05:09
31 Contacts		Own EPFD: GPS		
	Ship's Name	Range	Bearing	COG	SOG
1	Carron ----------	2.40 ---	232° ----	221.1° --	11.1 kn
2	Egeria ----------	3.85 ---	325° ----	205.1° --	19.1 kn
3	Yarmouth -------	4.38 ---	198° ----	041.1° --	12.9 kn
4	Vigilant ---------	5.00 ---	041° ----	221.0° --	26.1 kn
5	Fiskerton -------	5.01 ---	088° ----	115.0° --	02.0 kn
6	Nos Reves ------	5.47 ---	241° ----	091.1° --	11.4 kn
7	Alert ----------	5.50 ---	190° ----	303.8° --	10.0 kn
8	Wotton ----------	5.95 ---	255° ----	133.2° --	28.0 kn

Figure 1. The screen of a typical Minimum Keyboard Display.
Layout and presentation of information varies by manufacturer.

valuable. Whether that data aids or hinders collision avoidance will depend largely on:

a. how the data are displayed,
b. how the data are interpreted, and
c. how the data are used.

Where the AIS information is integrated with ARPA or ECDIS displays, there is undoubtedly an improvement in situation awareness. Even if only a MKD is fitted, the information could be helpful, but it will take good training and experience to interpret the data correctly. Figure 1 shows a typical MKD. The scenario it displays is in the Dover Strait, in the SW lane of the Traffic Separation Scheme, abreast of Sandettie Bank. This screen provides details of the nearest 8, out of the 31, AIS-fitted vessels that have been detected. At first sight, this mass of data appears to add little of value to collision avoidance. For example, to mariners more used to using compass bearings as the first frame of reference, the fact that the data are arranged in ascending order of the target's range will appear a little unusual. It would certainly take a real expert to convert, mentally, the information on this MKD into an all round picture, such as could be seen by looking out of the bridge window or from the radar display.

Figure 2 shows the corresponding radar display of those 8 AIS targets. It is set to the 6-mile range scale; it is in relative motion mode with 3-minute vectors. Based on what can be seen from this radar picture, or by looking out of the bridge window, five potential problem targets can be identified. Provided that the MKD and its related controls are user friendly, the relevant AIS data for each of the critical targets could now be displayed. Figure 3 shows the results of interrogating target number 6.
There are 14 contacts on the radar screen, but only 8 of those contacts appear on the AIS display. Clearly, it will take good training and experience to recognise which of the dozen lines of data in Figure 1 apply to the 14 radar contacts, and which of the 22 items in Figure 3 are relevant for collision avoidance purposes and how to make use of them. Certain specified vessel types, notably warships, naval auxiliaries and ships

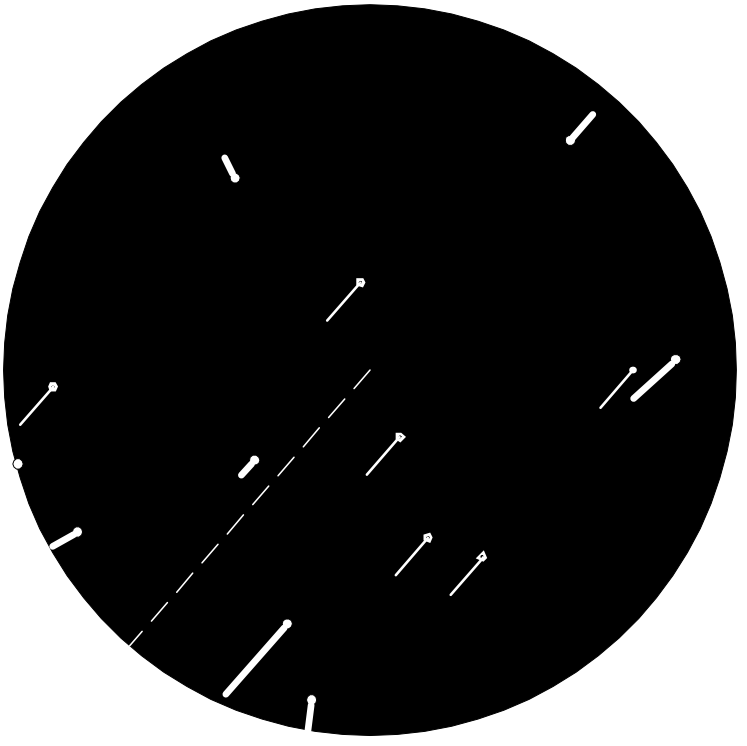

Figure 2. Radar Display.

Contact No:	6 of 31	Last updated:	2 m 26 sec
Ship's Name:	Nos Reves	Callsign:	MVKU9
IMO No:	213114227	MMSI:	6544
Position:	LAT: 51° 09.748′ N	LON: 001° 36.614′ E	
Heading:	087°	ROT:	N/A
COG:	091.1°	SOG:	11.4 kn
Type: Fishing Vessel		NavStat: Engaged in fishing	
Length: 25 m	Beam:	6m	Draught: 3.3 m
Elec. Pos. Fix Device: GPS		Position accuracy: High < 10 m	
Location of EPFD		A:15 B:10	C: 3 D:3 m
Destination:	N/A	ETA:	N/A
Cargo:	N/A		
DTE:	Available	RAIM:	In use

Figure 3. Typical display of additional information.

owned/operated by governments, are not required to be fitted with AIS.[9] Other objects, such as containers lost overboard, other flotsam and ice obviously will not be fitted with AIS! However, they may appear on the radar. The majority of leisure craft and fishing vessels are unlikely to be fitted with AIS for many years to come, if ever.

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It may also be some years before AIS transmitters are fitted to aids to navigation. Thus the picture presented by AIS may be incomplete and less reliable than that shown by radar.

6. RULE 3(k) – IN SIGHT. Rule 3(k) is uncompromising in its definition – Two vessels are deemed to be in sight of one another "… only when one can be observed visually by the other." Attempts to modify this definition to include radar detection have been resisted by the IMO. There appears to be no valid reason why this Rule should be amended for vessels fitted with AIS any more than for vessels fitted with radar.

7. RULE 5 – LOOKOUT. Rule 5 requires that a proper lookout be maintained "… by all available means …" It is widely acknowledged that this involves maintaining good "situational awareness" and reacting properly to the relevant facts and circumstances. Just as an OOW has to be trained in appropriate techniques to make optimum use of radar for collision avoidance, so also should all those charged with using AIS have a proper understanding of its outputs and how they should be interpreted. Proper recognition should be given to possible shortcomings of the AIS picture.

Keeping a good lookout involves the assimilation of information from a variety of sources to form a basis for decision-making. Normally, a vessel fitted with AIS will be expected to have it operating at all times. However, it may be switched off if the ship's master judges such action to be appropriate (e.g. where he considers that there is a major security risk, such as possible piracy). It is submitted that such occasions should be rare in European and North American waters. To deliberately deprive a ship of a useful navigation aid, e.g. by failure properly to use AIS, is likely to be regarded as "… neglect of [a] precaution which may be required by the ordinary practice of seamen …" and hence as a breach of Rule 2. It follows that a master's decision to switch off AIS, and the rationale behind that decision, should invariably be recorded in the ship's log.

In this electronic age, many watchkeepers tend to put more faith in electronic aids than is really warranted. This is regrettable, if understandable. Nevertheless, OOWs need to recognise that AIS will provide yet another distraction, and it could become a further excuse for reduced attention to keeping a proper visual lookout. AIS generated information, whether on stand-alone displays or shown on ARPA or ECDIS displays is also likely to divert attention away from CPAs and TCPAs derived from one's own ship's radar/ARPA if only because of its novelty value.

8. RULE 6 – SAFE SPEED. The wording of this rule has been framed in a way that allows for a measure of flexibility – "In determining a safe speed the following factors shall be **among** [emphasis added] those taken into account …" In principle, the availability of AIS information ought not to influence decisions regarding speed, which should normally be based on all the other factors. Nevertheless, it is likely that some modifications may eventually have to be made to Rule 6 to provide specific guidance on the use of AIS, along the same lines as that given

for radar. For example, the wording used for radar might be adapted to give guidance for AIS along the following lines:

"Additionally, by vessels with operational AIS:

(a) the characteristics, efficiency and limitations of the AIS equipment, including the absence, on board the recipient vessel, of integrity checks on the information which has been provided by a variety of sensors in the transmitting vessel;
(b) the effect on AIS equipment of GPS performance and of sources of interference on VHF transmissions;
(c) the fact that certain vessels, including warships, are not obliged to be fitted with AIS;
(d) the possibility that small vessels, particularly leisure craft, will not be fitted with AIS;
(e) the fact that ice and other floating objects cannot be detected by AIS;
(f) the number, location and movement of vessels detected by AIS. In particularly busy conditions, AIS information from some vessels may have to be curtailed;
(g) the correlation of AIS information with data derived from other sources including, but not restricted to, radar information."

9. RULE 7 – RISK OF COLLISION. In due course, it is likely that Rule 7 will have to be amended to recognise the effect of AIS. In the meantime, mariners will have to take account of AIS in applying the Rule. Under Rule 7(a) "Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists." There appears little doubt that AIS is one such *means*. It is difficult to envisage any common *prevailing circumstances and conditions* where it would not be appropriate to make use of the information that AIS can provide, particularly if that the information can be cross-checked with other data. Thus, the use of AIS information may already be "... a precaution which may be required by the ordinary practice of seamen ..."[10]

Rule 7(b) requires that "Proper use shall be made of radar equipment if fitted and operational ... and radar plotting or equivalent systematic observation of detected objects." Clearly, this could include intelligent correlation of radar and AIS information. Details such as course and speed as determined by ARPA, or other methods of plotting, should be compared with AIS information and the reason for any material differences investigated. The key is to use all available data and not rely on one single source. The admonition in Rule 7(c) not to make assumptions on the basis of scanty information will still be valid. However, the existence of a steady flow of AIS information **may** provide sufficient additional data to supplement what otherwise would have to be regarded as "scanty radar information". For example, intermittent radar echoes from within rain clutter might be resolved by AIS information.

AIS information may conflict with that shown by radar/ARPA for several reasons:

a. AIS is linked to GPS as its basis for positioning and for computing course and speed over the ground. Thus, any GPS errors will be reflected in the outputs. In principle, such errors should be rare and small, at least when DGPS is available.

However, the potential for errors of this nature cannot be ignored. Information on heading and rates of turn may be derived from other sensors. None of those sensors can be monitored by the receiving vessel, which nevertheless is expected to make judgements based, at least in part, on the information that they provide. Watchkeepers should be aware of this issue of integrity.

b. Radar/ARPA may be operated in a variety of modes. Many mariners still prefer to operate their true motion sets in water-stabilised, rather than ground-stabilised, mode. Others prefer to have at least one set showing relative motion. None of these will correspond directly with AIS information. Watchkeepers will need to be able to appreciate the effects of the differences.
c. On the other hand, AIS should normally give a much earlier and more accurate indication of changes of course and speed, particularly by larger vessels.
d. AIS information will be less affected than radar by the positioning of sensors and, more particularly, by the positioning of the main superstructure of the vessel, which is inevitably the main source of any radar echo.
e. There is a finite limit on the number of time slots (and hence the number of messages that can be handled) by existing AIS systems. In particularly busy areas, it may be necessary selectively to curtail certain messages.

Visual lookout, supplemented by radar, which in turn is supplemented by AIS, is likely to be the appropriate hierarchy for collision avoidance decisions for many years to come.

10. RULE 18 – RESPONSIBILITIES BETWEEN VESSELS. Rule 18 sets out a hierarchy for keeping out of the way of other vessels. In each case, vessels higher up the list must keep out of the way of vessels lower down the list (e.g. normally a sailing vessel must keep out of the way of a vessel engaged in fishing). It is important to note, however, that Rule 18 may itself be over-ridden in whole or part by other Rules (e.g. Rules 9 and 10 modify parts of Rule 18 in narrow channels and traffic separation schemes respectively). Privileged vessels are required to display particular combinations of lights and shapes, as set out in Rules 24 to 28. As many mariners will attest, particularly those in leisure craft, some of the daylight shapes are difficult to discern at distances of more than 1 to 2 miles, even with binoculars. Properly used, AIS can provide warning of a vessel with privileged status well before the relevant lights or shapes are likely to be seen visually. This ability to detect the limitations of vessels at very much greater ranges, both by day and night, should lead to improved safety and fewer "near misses". Nonetheless, the system has several shortcomings.

The first difficulty is that relevant information will be derived from two of the three types of AIS messages:

a. static messages, which includes the type of vessel;
b. dynamic messages, including position, course, speed and a limited choice of navigation status.[11]

Static data is likely to be stored in the system permanently, or entered once per voyage, possibly via a PC. It is unlikely to be changed while a vessel is under way. As the name implies, most dynamic messages will be changing constantly, normally based on a range of sensor inputs. However, the navigation status will usually have to rely

on manual input. The static information includes the type of vessel. The possible categories include sailing vessels, fishing vessels and vessels engaged in towing. The static information will not give any indication of whether a fishing vessel is actually engaged in fishing, or if a sailing vessel is also using power, or if a towing vessel is restricted in her ability to manoeuvre. Thus, it is of limited value in determining whether the vessel in question has any priority within the terms of Rule 18. Nevertheless, it adds another responsibility for the OOW in the receiving vessel because he/she is on notice that a vessel that **may** be privileged is in the vicinity. Every mariner is all too familiar with fishing vessels that leave their fishing cones permanently rigged often from their first trip to the fishing grounds until the vessel is scrapped. The sight of a sailing vessel clearly using her engine without displaying the appropriate cone (or lights at night) is equally familiar. Static messages provided by such vessels are likely to exacerbate that problem. Although unlikely to be a major issue in the short term, it could be increasingly problematic when Class B AIS becomes widely available.

At present, the transmission of the navigation status is stated to be "optional". However, until the Rules make specific reference to AIS, failure to transmit navigation status may still constitute a breach of the Rules on the basis that the transmission of such information is a "... precaution which may be required by the ordinary practice of seamen ..."[12] There are several choices available under the manual settings for the navigation status for use in dynamic messages, some of which indicate privileged status but others do not:

a. underway by engines,
b. at anchor,
c. not under command*,
d. restricted in ability to manoeuvre*,
e. moored,
f. constrained by draught*,
g. aground,
h. engaged in fishing*, and
i. underway by sail*.

* indicates a vessel with privileged status under Rule 18.

Those alternatives cover most situations for which the Rules specify particular lights and shapes. At present, AIS navigation status has no direct standing under the Rules. Nevertheless, the information that it provides would be a factor that should be taken into account under various Rules.

Arguably, the two most significant problems connected with the transmission of navigation status are that it is optional and that it will usually rely on manual input. In emergencies, making a change in the status could be overlooked, unless it can be linked, automatically, to the switching on of the appropriate combination of lights. Linking it automatically to the hoisting of the appropriate shapes will require considerable ingenuity!

Changing the status on AIS does not remove the obligation to display the appropriate shapes and lights. Indeed, the Rules specifically require that the relevant shapes and lights be displayed; so that should take priority. An OOW may forget to change the status setting once the need for privileged status has been removed. Once again, in due course, fishing vessels that are not actually engaged in fishing and sailing yachts under power could prove to be major irritants, notably because Class B AIS is not

required to include navigation status. The potential for ambiguous or misleading information will continue. Of particular concern would be the transmission of static information that was not supplemented by the transmission of an appropriate navigation status or which was not confirmed by the lights and shapes or by relevant sound signals. Training in the use of AIS will need to address these issues. As the number of vessels that are equipped with AIS increases, so too will the possibility that such errors of omission and commission will occur.

In due course, the IMO will need to consider modifying the Rules to give appropriate recognition to the navigation status messages transmitted by AIS. Similarly, consideration will have to be given to the position, both legally and practically, if a vessel fitted with Class A AIS does not transmit its navigation status (or AIS is not operating for some reason), or the wrong status is transmitted.

Watchkeepers should also be given advice on what record is to be kept of changes made to the AIS navigation status signal. It is suggested that an entry should be made in the log each time that the AIS status is changed. This would be in addition to any other entries that may be made, such as to record switching on the appropriate lights. It would also be logical, in due course, to require a link between the AIS equipment and the VDR (Voyage Data Recorder), to ensure that there is an accurate record of such changes.

11. RULE 19 – RESTRICTED VISIBILITY. In due course, some amendments will be required to this Rule, and particularly Rule 19(d). AIS will provide another tool to assist in determining whether a risk of collision exists. Not only is it likely that vessels fitted with AIS will be detected earlier than detection by radar, but it should normally also give earlier indication of any manoeuvres undertaken by that vessel, whether they are alterations in course or speed. This implies that it will be necessary to keep a close and frequent watch on the AIS information in certain circumstances. Clearly, where AIS information is fused with the radar picture, such continuous monitoring will be relatively easy. In other cases, the MKD should be in close proximity to the radar screen that is likely to be used in restricted visibility. There could well be circumstances, such as in narrow channels, traffic separation schemes, and points of traffic convergence where both radar and the MKD screens should be manned separately. The Rules that apply in restricted visibility can be considered in five parts:

a. Fog signal heard apparently forward of the beam – Rule 19(e) then gives the appropriate action, except where it has been determined that no risk of collision exists.
b. Where a close quarters situation with another vessel forward of the beam cannot be avoided. Again, Rule 19(e) then governs the action to be taken.
c. Where the other vessel has been detected by radar, and it has been determined that no risk of collision exists and/or a close-quarters situation in not developing – In this case, no action is required, other than to continue monitoring the position.
d. Where the other vessel has been detected by radar, **and** a risk of collision exists, or a close quarters situation is developing – Rule 19(d) then provides further guidance. Such cases may very soon develop to the position where Rule 19(e) applies.

e. As soon as the other vessel comes into sight, the Rules of Section II apply. [13] This will include the manoeuvring and warning sound and light signals in Rule 34.

It will be noted that three key issues are:

a. Is there a risk of collision?
b. Can a close quarters situation be avoided?
c. Rule 19(d) applies only where a vessel detects another vessel "… by radar alone. …"

AIS can assist in determining whether a close quarters situation is developing and/or whether there is a risk of collision. In that respect, it is a useful supplement to radar. If the primacy of radar is accepted and also that AIS is merely a supplementary tool, then the first sentence of Rule 19(d) could now be read as "A vessel which detects the presence of another vessel by radar, whether alone or in combination with AIS, shall determine if a close-quarters situation is developing and/or risk of collision exists".

It is likely that the claim that radar should be the determining factor will eventually be open to challenge, notably because of the probability of detection at a greater range by AIS, because AIS is less prone to "interference" in the broadest sense (e.g. rain clutter), and because of the better quality and quantity of information available via AIS, under normal circumstances. However, until the reliability of AIS under all operating conditions has been established beyond doubt and its shortcomings have been properly identified and investigated, and until AIS is fitted very widely, it is suggested that detection by AIS alone should not be sufficient to modify the requirements of Rule 19. At the very least, a competent seaman is unlikely to be prepared to rely on one source of information (be it AIS or radar) especially if it appears to be contradicted, or not supported, by information from other sources.

In summary, AIS may enable one effectively to modify the first sentence of Rule 19(d), but it does not provide a sound reason for any further liberalisation of the Rule. In the circumstances where Rule 19(d) applies, AIS is in the same position as radar – i.e. it may aid the satisfactory resolution of a close quarters situation, or of a risk of collision, but it provides no justification for not following the strict terms of the Rule. Initially, detection by AIS alone should be considered in the same way as detection by radar alone, with particular caution being exercised until the AIS information has been verified by other means. Without such verification, it is submitted that it would be impossible to conclude that no risk of collision exists, particularly if no radar contact can be seen.

12. A MONITORING ROLE. AIS has an important monitoring role, not only in assisting watchkeepers to make an early assessment of whether a risk of collision exists, but also subsequently in enabling them to monitor action taken by other vessels. For example, it will help a stand-on vessel to determine whether the other vessel has complied with Rules 8 (action to avoid a collision) and 16 (action by give-way vessel).

There have now been sufficient cases involving Rule 17 (action by stand-on vessel)[14] to establish some broad guidelines as to when a stand-on vessel should start to take

action if the give-way vessel does not appear to be doing so. Rule 17 has always posed two major dilemmas:

a. how and when does it become apparent that the other vessel is not taking appropriate action?[15], and
b. how can the watchkeeper in the stand-on vessel assess whether collision can be avoided by the action of the give-way vessel alone,[16] particularly at night?

AIS should assist in resolving both of these dilemmas by providing a stream of relevant information. Normally, the dynamic messages should provide much earlier and more accurate information than radar of whether there has been any alteration in the course and speed of the other vessel and whether the alterations were positive and with due regard to good seamanship[17], and were substantial.[18] The static messages will provide a broad picture of the size and type of the other vessel and hence give an indication of her likely manoeuvring characteristics. Thus, useful information can be provided by AIS, but it must still be evaluated alongside other data, particularly by "looking out of the window"!

13. THE USE OF VHF – AGAIN. It is not the purpose of this paper to resurrect the long-standing debate on the use of VHF for collision avoidance. Those who support the use of VHF can now argue that it is possible positively to identify the vessel that is to be called, so that the dangers of mistaken identification are removed, or reduced. On the other hand, AIS should provide sufficient additional information to determine whether a risk of collision exists without the problems of different languages, accents and cultures that are inherent in any VHF communications. If proper use is made of AIS information, it is arguable that few VHF conversations should be necessary. The time involved in making a call would often be better spent in considering what action is required by the Rules, taking that action and then monitoring the position.

It is probably pointless to try to stem the tide of VHF exchanges. In areas where American law applies, the use of VHF is obligatory in many cases.[19] Moreover, the Admiralty Court now recognises that VHF exchanges can be useful in certain circumstances, notably for exchanges of information, such as where the give-way vessel: " … informs the other vessel of action being taken in order to comply with the collision regulations."[20] However, that should **not** be read as giving tacit approval to the two vessels then agreeing on a course of action which is in conflict with the collision regulations, a point which is reiterated in strong and unambiguous terms in both the IMO and the MCA general guidelines.[21] Moreover as the *Mineral Dampier* case[22] demonstrated very clearly, it is important for both vessels to continue monitoring one another's movements notwithstanding any VHF exchange. The stand-on vessel in particular should be prepared to take appropriate action if it becomes clear that the measures discussed by VHF are not in fact being implemented.

There is considerable evidence, albeit largely anecdotal, that many watchkeepers place undue reliance on electronic aids of all descriptions, as shown by the ever-increasing use of waypoint navigation, coupled with a reluctance to stray from an electronically determined path. Unnecessarily close passing also appears to be on the increase. Those facts, taken together with the ability of AIS to provide positive

identification of an otherwise anonymous radar echo, leave the author with the uneasy feeling that AIS is likely to lead to more, rather than less, VHF chatter and a significant increase in the number of negotiated manoeuvres that are totally contrary to the Rules. If Regulators want to make a positive contribution to the use of AIS for collision avoidance, they should make it clear that they will take the strongest possible measures against the owners, masters and watchkeepers of vessels that agree on courses of action that are not in accordance with the Rules.

14. CONCLUSIONS. As the MCA have pointed out, "AIS is a new and untried system, but with the potential to make a significant contribution to safety."[23] It does not change directly the requirements of the Rules, although it does provide an important source of additional information that should enable watchkeepers to enhance their "situation awareness".

One of the targets in Figures 1 to 3 provides an illustration of the assistance that AIS can provide, but also demonstrates that AIS is no panacea. That target (number 6 in Figure 1) is fine on the starboard bow. On the face of it, we are the give-way vessel. The MKD shows that the vessel is on a heading of 087°, and is making good a course of 091°, and a speed of almost 12 knots. If the OOW has good position awareness, he will know that the target has entered the SW lane of the traffic separation scheme, heading in the wrong direction, and certainly not crossing at right angles to the general direction of the traffic flow. From Figure 3, the OOW can determine that the target is a fishing vessel; the navigation status indicates that she is engaged in fishing. Since she is travelling at 12 knots, there should be some doubt in the OOW's mind as to whether she is actually fishing. That suggests that the skipper may not have bothered to change the navigation status since starting to fish on this trip, and possibly not since the vessel was purchased!

If she does change course, to comply with Rule 10, the alteration of course will be detected much sooner on the MKD than detection by radar and possibly before such a change could be detected visually. If she is in fact fishing, Rule 10(i) states that she must not impede the passage of any vessel following the SW traffic lane. As a result, she has to keep out of the way of our vessel. However, we may still have to take avoiding action in due course if she fails to do so, by virtue of Rule 10(a), coupled with other Rules. In that example, visual observation, the radar display and the AIS information have provided the watchkeeper with a timely warning of a potential rogue fishing vessel that is likely to cause him/her some anxious moments! AIS has also provided potentially useful additional information.

In the ultimate analysis, AIS is, like radar, nothing more than one of several tools designed to enable mariners to fulfil their obligations under the Rules. OOWs should constantly remind themselves that "It is on men that safety at sea depends and they cannot make a greater mistake than to suppose that machines can do it for them."[24] To which might usefully be added – "Never, ever, rely on only one source of information when other data are available."

REFERENCES

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[2] Carriage requirement in SOLAS V, Regulation 19, paragraph 2.4. See also Recommendation on performance standards for a universal AIS – Resolution MSC 74(69), annex 3.

[3] The International Regulations for Preventing Collision at Sea 1972.
[4] The Nautical Institute – *Improving the application of the COLREGS* – Report of a study conducted in 2003.
[5] As an example of further comments on this point see Peter Hinchcliffe. Shipowners' views on AIS. A paper presented at a joint IMO/IALA seminar on AIS.
[6] See, for example, Captain C. R. Pratt and Captain G. Taylor. AIS – A pilot's perspective. A paper presented at the Royal Institute of Navigation's AIS 03 Conference.
[7] The *Nora* [1956] 1 LLR. 617, per Willmer, J., at page 626, column 1.
[8] The *Miguel de Larrinaga* [1956] 2 LLR 530, per Willmer, J. at page 538, column 1.
[9] SOLAS Chapter V, Regulation 1, Paragraph 1.1
[10] Rule 2(a).
[11] For a more complete description see, for example Harre, I. AIS – Adding new quality to VTS systems. This *Journal*, **53**, 527; or IALA Guidelines on the Universal Automatic Identification System. Volume 1, Part 1 – Operational Issues. Edition 1.1. Available from www.iala-aism.org
[12] Rule 2(a).
[13] The *E.R.Wallonia* [1987] 2 LLR 485, notably at page 488, column 1.
[14] Notably, the *Iran Torab* [1988] 2 LLR 38, the *Koscierzyna* and *Hanjin Singapore* [1996]. 2 LLR 124, the *Mineral Dampier* and *Hanjin Singapore* [2000] 1 LLR 282 and [2001] 2 LLR 419, the *Sitarem* and *Spirit* [2001] 2 LLR 107, and the *Topaz* and *Irapua* [2003] 2 LLR 19.
[15] The basis for a decision by the stand-on vessel to take action under the terms of Rule 17(a)(ii).
[16] The basis for a requirement for the stand-on vessel to take action under the terms of Rule 17(b).
[17] As required by Rule 8, notably 8 (a)–(c).
[18] As required by Rule 16.
[19] For further discussion on this point see Stitt, I. P. A. The use of VHF in collision avoidance at sea. This *Journal*, **56**, 67.
[20] Per Lord Phillips, M. R. in the *Mineral Dampier* and the *Hanjin Madras* – [2001] 2 LLR 419 at page 428, paragraph 38.
[21] IMO Resolution A.917 (22), annex, paragraph 40.2; and MCA publication *Safety of Navigation – Implementing SOLAS Chapter V, 2002*, Annex 17.
[22] The *Mineral Dampier* and the *Hanjin Madras* – [2001] 2 LLR 419
[23] MCA publication *Safety of Navigation – Implementing SOLAS Chapter V, 2002*, Annex 17.
[24] Per Cairns, J. in The *Togo* – [1967] 2 LLR 208 at page 221, column 2.