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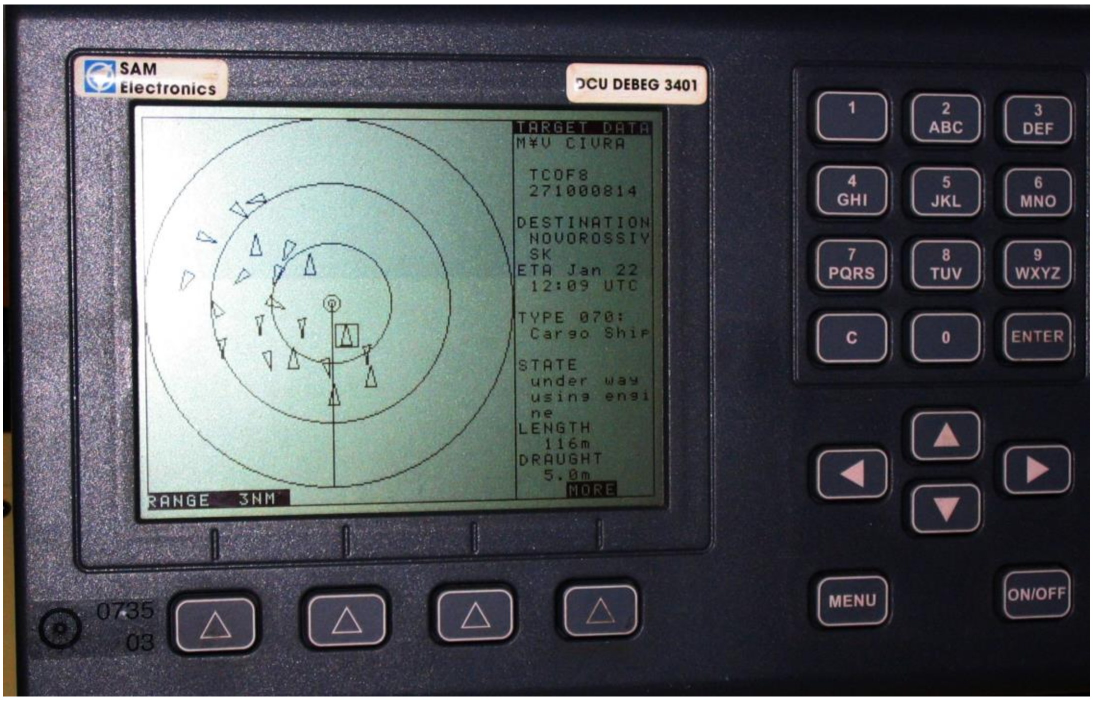
PROBLEMS ENCOUNTERED WITH AUTOMATIC IDENTIFICATION SYSTEM (AIS) FOR LAWYERS AND INSURERS



BY

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"It is on men that safety at sea depends and they cannot make a greater mistake than to suppose that machines can do all their work for them"

(Justice Cairns, in the English Admiralty Court, 1967)

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CONTENTS

1.0 INTRODUCTION

1.1 When consulting and providing expert opinion on collision cases we are finding that there is a continual over-reliance and operator error when navigating officers are using AIS.

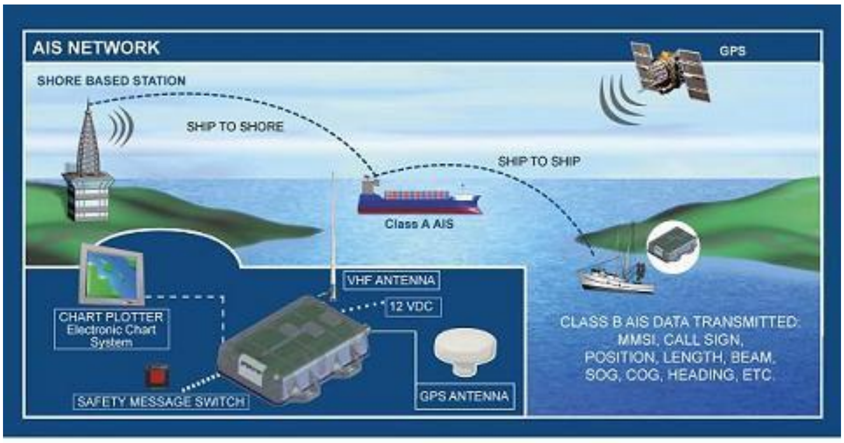
1.2 AIS should only be seen as a 'tool' in assisting the navigating officer and not as the sole basis of making decisions in collision avoidance or other navigational situations.

1.3 This article does not take into account the advantages that AIS has to shore side Vessel Traffic Services (VTS). The monitoring of such is obviously advantageous for search and rescue operations and to monitor and instruct traffic accordingly.

1.4 In this short article I will briefly touch upon the issues encountered with AIS.

2.0 WHAT IS AIS AND S-AIS?

2.1 The **Automatic Identification System** (**AIS**) is a tracking and identification system used by ships and by vessel traffic services (VTS). It identifies and locates vessels by electronically exchanging data with other nearby ships and AIS base stations.



2.2 The Satellite-AIS (S-AIS) is simply when designated AIS satellites are used to detect AIS signatures from ships.

2.3 The aim of AIS is to enhance: safety of life at sea; the safety and efficiency of navigation; and the protection of the marine environment.

2.4 SOLAS regulation V/19 requires that AIS data be exchanged from ship-to-ship and with shore-based facilities.

2.5 The purpose of AIS is to identify ships and <u>assist in target tracking</u>. It also assists in search and rescue operations and should reduce or simplify the exchange of verbal information.

2.6 Furthermore, AIS is supposed to assist in the situational awareness of the navigating officer.

2.7 Statutory requirements state that AIS is to be fitted aboard international voyaging ships with gross tonnage (GT) of 300 or more, and all passenger ships regardless of size.

3.0 AIS INFORMATION

3.1 An AIS transceiver sends a stream of static and dynamic data at various time intervals. The time intervals are dependent on the class of transceiver, content and nature of data. These include but are not limited to:

- Maritime Mobile Service Identity (MMSI) – a nine-digit identification number
- Navigational status – at anchor, aground, under way, not under command etc.
- CPA (closest point of approach)
- TCPA (time to closest point of approach)
- Rate of turn
- Speed
- Position
- Course over ground
- True heading
- True bearing at own position
- Time
- IMO ship identification number
- Radio call sign
- Name of ship
- Type of ship/cargo

- Dimensions of ship
- Location of positioning systems
- Type of positioning system – such as GPS
- Draught of ship
- Destination
- ETA

3.2 The AIS information is normally displayed on the ECDIS (Electronic Chart Display Information System) particularly on large commercial ships.

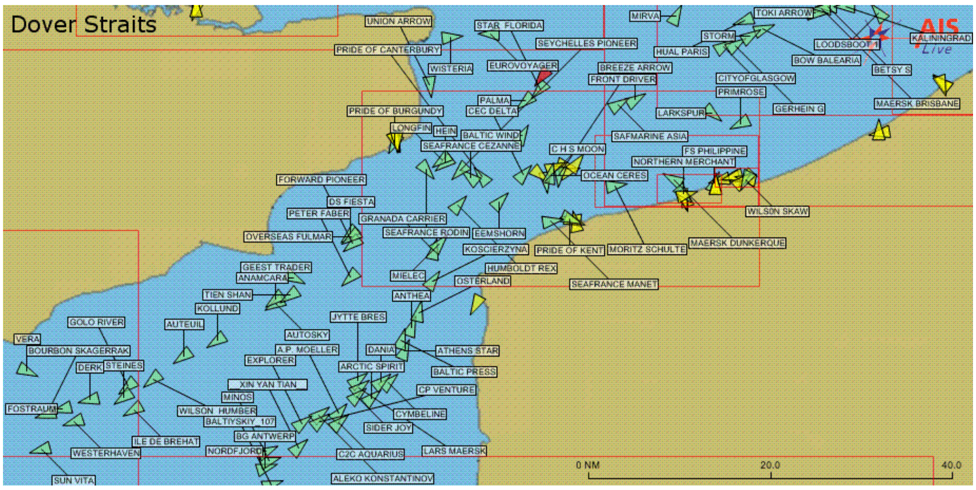
4.0 <u>HOW DOES IT WORK?</u>

4.1 AIS have an integrated standardized VHF transceiver with a positioning system such as a GPS. In turn this can be connected with other electronic navigation sensors, such as a gyrocompass or a rate of turn indicator. In turn the AIS, ECDIS and radar are all inter-connected with each other.

4.2 Ships fitted with AIS are tracked by AIS base stations, which are located along coastlines.

4.3 Additionally S-AIS tracks ships by satellites that are fitted with special decoding receivers that can handle a large number of signatures over a large footprint.

4.4 Generally the effective range of AIS data is somewhere between 12 and 30 miles. Base stations have an effective range of 40nm and S-AIS can collect data from a 3000-mile footprint.



4.5 The AIS data is normally displayed on the ECDIS as contributing navigational information in a similar way to the radar information.

4.6 There are two (2) types of AIS transceiver, Class A and Class B. The Class A transceivers are aimed at the commercial market and the Class B is aimed at the lighter commercial and leisure markets.

5.0 DISADVANTAGES OF AIS

5.1 Speed issues

5.2 The default setting on all AIS transceivers with regards to speed is, 'speed over the ground' (SOG) and is obviously derived from the GPS. However, it has been noted by many that if the GPS loses its signal the AIS unit will default to the Doppler log (water speed). It has even been the case that if the Doppler log engages ground tracking mode the AIS will default to Doppler automatically and drop the GPS SOG.

5.3 Time stamp issues and processing times (S-AIS)

5.4 The data information that is broadcast must include a time stamp in order to provide accurate 'real-time' information. Processing times for standard AIS are often in milliseconds and consequently there is a small latency in the system. When using S-AIS there is a processing time for the satellite to upload the AIS data from its footprint, which may consist of thousands of ships. The data is then stored on board the satellite and downloaded once a ground earth station is detected. From the ground earth station, the data is transmitted to a central data processing centre. Finally, that data is

processed into messages and time stamped accordingly. Therefore, the latency within a S-AIS is greatly more and thus using S-AIS to compute speed and performance disputes can be fraught with challenges as there are multiple steps to check to ensure that charter party service speeds are accurate. **(Nathan's note to readers - This is my next article - Speed and Performance Issues Using S-AIS).**

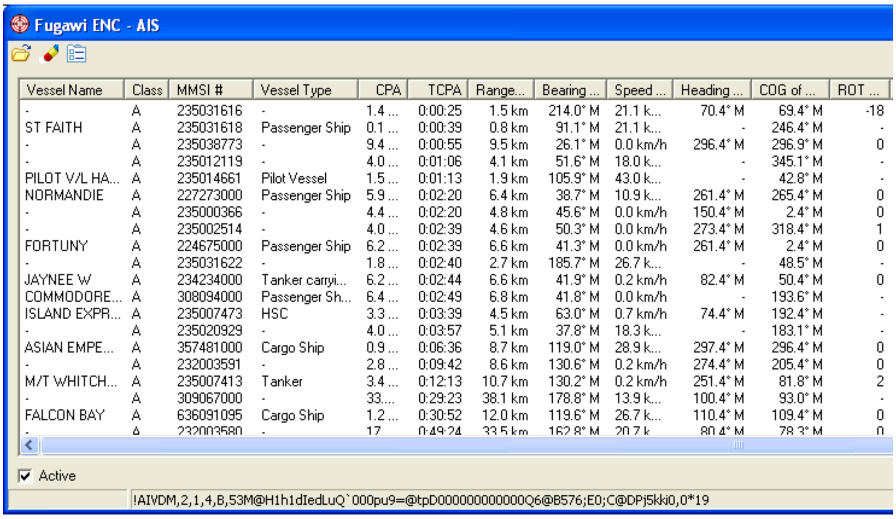
5.5 S-AIS target is lost

5.6 AIS Satellites can take up to 3 hours to report the position of a ship. So, what happens when an AIS target is lost and more importantly how long will it remain on the screen? When a message is received from a ship it creates a 'dot' or symbol on the user's screen. When a new message is received the old dot is removed and a new dot is placed in the new position. When a ship is not heard from the AIS display will keep the old dot on the screen for periods of whatever the system has been configured for. Eventually the dot will disappear…but obviously not the ship…hopefully!

5.7 It should be noted that if the dot has not moved this does not mean that the ship has not moved; perhaps the signal has been lost or the AIS has been turned off!

5.8 Inaccuracy of Information

5.9 It has often been the case that the information transmitted by AIS has been incorrect. VTS operators estimate that over 60 percent of messages are incorrect. 'Garbage in, garbage out' (GIGO) is therefore appropriate.



Fugawi ENC - AIS

Vessel Name	Class	MMSI #	Vessel Type	CPA	TCPA	Range...	Bearing ...	Speed ...	Heading ...	COG of ...	ROT ...
-	A	235031616	-	1.4 ...	0:00:25	1.5 km	214.0° M	21.1 k...	70.4° M	69.4° M	-18
ST FAITH	A	235031618	Passenger Ship	0.1 ...	0:00:39	0.8 km	91.1° M	21.1 k...	-	246.4° M	-
-	A	235038773	-	9.4 ...	0:00:55	9.5 km	26.1° M	0.0 km/h	296.4° M	296.9° M	0
-	A	235012119	-	4.0 ...	0:01:06	4.1 km	51.6° M	18.0 k...	-	345.1° M	-
PILOT V/L HA...	A	235014661	Pilot Vessel	1.5 ...	0:01:13	1.9 km	105.9° M	43.0 k...	-	42.8° M	-
NORMANDIE	A	227273000	Passenger Ship	5.9 ...	0:02:20	6.4 km	38.7° M	10.9 k...	261.4° M	265.4° M	0
-	A	235000366	-	4.4 ...	0:02:20	4.8 km	45.6° M	0.0 km/h	150.4° M	2.4° M	0
-	A	235002514	-	4.0 ...	0:02:39	4.6 km	50.3° M	0.0 km/h	273.4° M	318.4° M	1
FORTUNY	A	224675000	Passenger Ship	6.2 ...	0:02:39	6.6 km	41.3° M	0.0 km/h	261.4° M	2.4° M	0
-	A	235031622	-	1.8 ...	0:02:40	2.7 km	185.7° M	26.7 k...	-	48.5° M	-
JAYNEE W	A	234234000	Tanker carryi...	6.2 ...	0:02:44	6.6 km	41.9° M	0.2 km/h	82.4° M	50.4° M	0
COMMODORE...	A	308094000	Passenger Sh...	6.4 ...	0:02:49	6.8 km	41.8° M	0.0 km/h	-	193.6° M	-
ISLAND EXPR...	A	235007473	HSC	3.3 ...	0:03:39	4.5 km	63.0° M	0.7 km/h	74.4° M	192.4° M	-
-	A	235020929	-	4.0 ...	0:03:57	5.1 km	37.8° M	18.3 k...	-	183.1° M	-
ASIAN EMPE...	A	357481000	Cargo Ship	0.9 ...	0:06:36	8.7 km	119.0° M	28.9 k...	297.4° M	296.4° M	0
-	A	232003591	-	2.8 ...	0:09:42	8.6 km	130.6° M	0.2 km/h	274.4° M	205.4° M	0
M/T WHITCH...	A	235007413	Tanker	3.4 ...	0:12:13	10.7 km	130.2° M	0.2 km/h	251.4° M	81.8° M	2
-	A	309067000	-	33....	0:29:23	38.1 km	178.8° M	13.9 k...	100.4° M	93.0° M	-
FALCON BAY	A	636091095	Cargo Ship	1.2 ...	0:30:52	12.0 km	119.6° M	26.7 k...	110.4° M	109.4° M	0
-	A	232003580	-	17	0:49:24	33.5 km	162.8° M	20.7 k	80.4° M	78.3° M	0

Active

!AIVDM,2,1,4,B,53M@H1h1dIedLuQ`000pu9=@tpD000000000000Q6@B576;E0;C@DPj5kki0,0*19

5.10 Message code abbreviations for data are not unified, such as port name, cargo and type of ship etc.[1]

5.11 Furthermore, the pronunciation of maritime vocabulary is different between certain languages, which means that the spelling is often wrong.

5.12 Collision Regulation Violation

5.13 As discussed in my last article on 'Problems Encountered with ECDIS', it has often been the case that anti-collision manoeuvres have been based on assumptions that AIS information is correct. Such assumptions include port of destination, course, speed, draught, etc. Navigating officers making collision avoidance decisions on AIS information such as assuming a ship will alter to port for a nearby port, when in fact the intention is for the other ship to continue along its merry way has resulted in collisions and many close quarters situations. The Collision Regulations are often ignored in favour of the information displayed on the AIS and subsequent alterations are based on assumptions.

5.14 Risk to small boats

5.15 The regulations stipulate that: "*All ships of 300 gross tonnage and upwards engaged on international voyages and cargo ships of 500 gross tonnage and upwards not engaged on international voyages and passenger ships irrespective of size shall be fitted with an automatic identification system (AIS)…"*

5.16 It is often incorrectly assumed that the majority of maritime traffic including small boats, yachts and light commercial traffic will carry an AIS transceiver. However, that is the viewpoint from a western position. Other areas in the world may not have the financial means or may not be able to obtain an AIS transceiver and so a generalization should not be made particularly with 3rd world countries.

5.17 Poorly located AIS display units

This is often reported in other technical papers on AIS as being an issue, however most AIS units are integrated in the Radar and ECDIS. However, poorly sited antennas or damaged antennas can reduce the effectiveness of the signals.

5.18 Switching off AIS

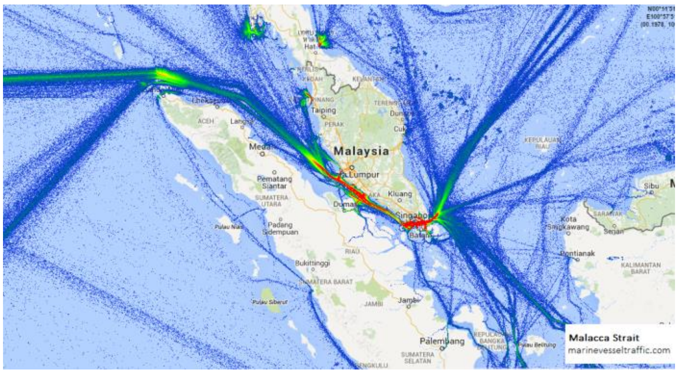
5.19 It is clear within the regulations that the AIS may be switched off under certain conditions on the master's professional judgement. Therefore, over-reliance on the AIS combined with 'ECDIS screen fixation' can lead to collision and close-quarters situations developing. It is a common occurrence with military ships and ships transiting areas of piracy to switch off the AIS.

5.20 VHF/AIS assisted collisions

5.21 VHF conversations have commonly been the cause of collisions. AIS is supposed to reduce VHF chatter, however, as more ships are readily identifiable the VHF traffic has increased (talking for the sake of talking). This in turn, particularly in extremely dense traffic situations, has caused the two ships communicating to agree on certain alterations without taking into account third party ships that may be affected by such agreements. While one-on-one collision situations may be resolved this way (although I do not recommend VHF to resolve collision situations personally), situations where there are 3 or more other ships, particularly in combination with assumed port destinations, may find personal agreements to their detriment. Just because a ship's name and other 'interesting' data are available does not necessitate a VHF conversation and the navigating officer should stick to the collision regulations.

5.22 Data overload

5.23 As discussed in my previous ECDIS article, the data information overlaid on the ECDIS can be overwhelming and saturate the screen. Add in the AIS information and the AIS vectors on the radar and it is easy to see how one could be over-loaded.



Malacca Strait - Imagine that zoomed in!

5.24 Loss of 'Reality'

Let us combine AIS with ECDIS and ask the question are we losing touch with reality, i.e. the view out of the bridge windows. In my opinion the navigating officer now has a toolbox of electronic gizmo's that may be played out as an electronic 'arcade game' of navigation. There is a loss of reality whereby the computer screen sucks the navigating officer in and away from the windows and set of binoculars. The name of a vessel, port of destination, cargo, draught, ETA and dimensions are really not that important in most cases and are of mindless fascination only.

5.25 Loss of Aspect and Time and Tide Waits for No Man!

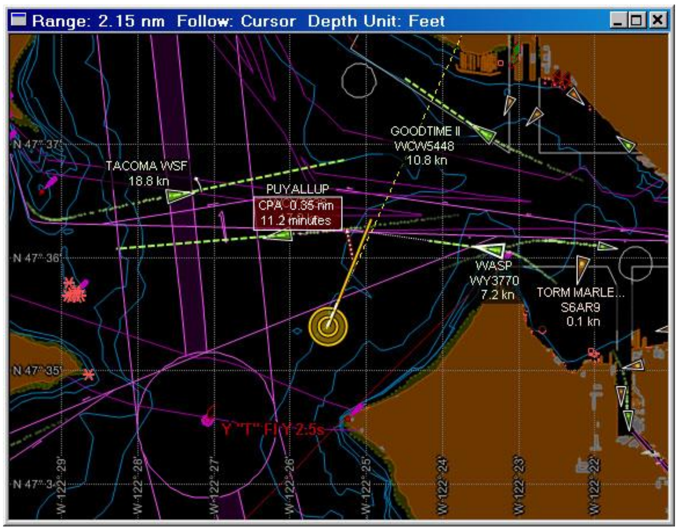
There is a loss of visual aspect, whereby the navigating officer loses the ability to determine the actual aspect of the vessel and instead concentrates entirely on the course over the ground to determine collision avoidance manoeuvres. The basic navigational importance of set and drift becomes lost amongst the clutter of true and/or relative vectors and AIS and ECDIS data information over-load.

5.26 Over-reliance on the gyroscopic (compass) data from the transmitting vessel is not backed up by visually checking the actual aspect of the vessel. Captain - *"Is she crossing, drifting or restricted in her ability to manoeuvre? Has anyone looked out of the bridge windows recently?"*

5.27 <u>What's my Vector Victor?</u>

5.28 The AIS data can overlay its own vectors onto the radar target in conjunction with the ARPA vectors. So now we have two vectors (ARPA being the other one) on one target. Which vector is which? In confined and heavy traffic, the number of targets acquired can lead to ARPA vector swap. So, if the vector left on the target is AIS after ARPA vector swap has taken place and the AIS information transmitted is wrong, then Houston we have a problem.

5.29 Furthermore, which vector do we believe with regards to the collision information. I have never seen in my career the ARPA and AIS vector exactly line-up with each other.



5.30 Basing collision information on AIS data is foolhardy as the radar stabilisation and differing motion modes may trick the navigating officer in not being able to differentiate and calculate important factors such as set and drift and speed over the ground or speed through the water.

6.0 IMPACT ON COLREGS

6.1 To explain the ramifications of using AIS as a means of avoiding collision with regards to the Collision Regulations would be extremely lengthy and so I will highlight briefly the collision regulation rules whereby there may be challenging implications involved.

6.2 Rule 5 - Lookout - In particular the wording '*by all available means'*.

6.3 Rule 6 - Safe Speed - In particular the wording *'The possibility that small vessels, ice and other floating objects may not be detected by radar at an adequate range'*

6.4 Rule 7 - Risk of Collision - In particular the wording *'Assumptions shall not be made on the basis of scanty information, especially scanty radar information.*

6.5 Rule 8 - Action to Avoid Collision - In particular the wording *'Any action taken to avoid collision shall be taken in accordance with the Rules of this Part…'*

6.6 Rule 19 - Restricted Visibility - In particular the wording '*A vessel which detects by radar alone the presence of another vessel shall determine if a close-quarters situation is developing and/or risk of collision exists.'*

7.0 IMPACT ON RADAR

7.1 AIS should not and does not replace Radar.

7.2 The use of the AIS CPA (closest point of approach) function has in some circumstances fully replaced the ARPA CPA function. The navigating officer is using the AIS CPA to determine collision avoidance.

7.3 The targets specific unique data from their own instrumentation is transferred and replicated on to the other vessel's radar. As unique navigational settings and actual equipment manufacturers are normally different the acronym of garbage in, gospel out (GIGO) would be appropriate.

8.0 ADVANTAGES OF AIS

8.1 Detecting targets by ARPA (Automatic Radar Plotting Aid) that may be obscured by a bend in a narrow channel, offshore installations and even bridges can sometimes be problematic. However, AIS has the advantage of being able to detect those targets and give the navigating officer time to make informed decisions.

8.2 Secondly, in areas of restricted visibility those targets that are masked by sea state, weather and other sources of interference can be detected by AIS and again the navigating officer can make informed decisions and apply the collision regulations accordingly.

8.3 Lastly the time lag when using AIS compared to ARPA is less, which may result in a better appreciation of a vessel altering course and thus the navigating officer has more time to make an informed decision. However, I believe in most circumstances that looking out of the window is probably a better option.

9.0 USCG FINES

9.1 Failure to adhere to the IMO guidelines for AIS in U.S. waters can result in civil penalties not exceeding $25,000. The maximum penalty for a false distress or a hoax is ten years in prison, a $5,000 civil fine, $250,000 criminal fine, and restitution of United States Coast Guard response costs.

10.0 CONCLUSIONS

10.1 While AIS provides a valuable tool for the navigating officer, over-reliance, GIGO and incorrect use can result in collisions.