MARINE SAFETY INVESTIGATION REPORT

Safety investigation into the collision involving the Maltese registered bulk carrier

GORTYNIA

and the Liberian registered bulk carrier

DZ QINGDAO

in the Singapore Strait

on 17 May 2017

201705/025

MARINE SAFETY INVESTIGATION REPORT NO. 11/2018

FINAL

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LIST OF REFERENCES AND SOURCES OF INFORMATION

Managers of MV Gortynia

Master and crew members of MV Gortynia

Voyage Data Recorder of MV Gortynia

ECDIS of MV Gortynia

AIS data and VTIS VHF transcript by the Maritime and Port Authority of Singapore
# GLOSSARY OF TERMS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>Able bodied seaman</td>
</tr>
<tr>
<td>AIS</td>
<td>Automatic Identification System</td>
</tr>
<tr>
<td>ARPA</td>
<td>Automatic Radar Plotting Aid</td>
</tr>
<tr>
<td>BSM</td>
<td>Bernard Schulte Ship Management</td>
</tr>
<tr>
<td>COLREGs</td>
<td>International Regulations for Preventing Collisions at Sea 1972 (as amended)</td>
</tr>
<tr>
<td>ECDIS</td>
<td>Electronic Chart Display and Information System</td>
</tr>
<tr>
<td>ETA</td>
<td>Estimated time of arrival</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>GT</td>
<td>Gross tonnage</td>
</tr>
<tr>
<td>kW</td>
<td>Kilowatt</td>
</tr>
<tr>
<td>LOA</td>
<td>Length overall</td>
</tr>
<tr>
<td>LT</td>
<td>Local time</td>
</tr>
<tr>
<td>m</td>
<td>Metres</td>
</tr>
<tr>
<td>MPA</td>
<td>Maritime and Port Authority of Singapore</td>
</tr>
<tr>
<td>MSIU</td>
<td>Marine Safety Investigation Unit</td>
</tr>
<tr>
<td>nm</td>
<td>Nautical miles</td>
</tr>
<tr>
<td>OOW</td>
<td>Navigational officer of the watch</td>
</tr>
<tr>
<td>PEBG B</td>
<td>Pilot Eastern Board Ground Bravo</td>
</tr>
<tr>
<td>SOG</td>
<td>Speed over ground</td>
</tr>
<tr>
<td>SOLAS</td>
<td>International Convention on the Safety of Life At Sea, 1974, as amended</td>
</tr>
<tr>
<td>STCW Convention</td>
<td>International Convention on Standards of training, Certification and Watchkeeping for Seafarers, 1978, as amended</td>
</tr>
<tr>
<td>TSS</td>
<td>Traffic Separation Scheme</td>
</tr>
<tr>
<td>UTC</td>
<td>Universal Time Coordinated</td>
</tr>
<tr>
<td>VDR</td>
<td>Voyage data recorder</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>VHF</td>
<td>Very high frequency</td>
</tr>
<tr>
<td>VTIS</td>
<td>Vessel Traffic Information Services</td>
</tr>
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</table>
SUMMARY

At about 0030 (UTC +8) on 17 May 2017, Gortynia, a fully laden cape size bulk carrier, collided with bulk carrier DZ Qingdao in Singapore Strait. The collision occurred in the East-bound deep water route of the traffic separation scheme (TSS) off Batu Berhanti.

Gortynia sustained major damage to her port side forward ballast tanks both above and below the waterline. The vessel also sustained varying degrees of damage to the port side hull and deck fittings from cargo hold no. 1 to just forward of the accommodation. DZ Qingdao also sustained major damages to her bow. Both vessels were able to proceed to an anchorage, off Singapore where the respective damages were assessed.

The safety investigation concluded that prior to DZ Qingdao suffering a power loss resulting in a temporary loss of propulsion and steering, both vessels were approaching each other in their respective traffic separation lanes and were to pass clear of each other. The change in DZ Qingdao’s heading and speed meant that she now was at risk of collision with Gortynia as they approached each other. This change was not noted on board Gortynia as the bridge team were only monitoring AIS targets on its radars, and with the loss of power on board DZ Qingdao, the AIS transmission ceased, causing the loss of the AIS plot. DZ Qingdao did not warn VTIS and the surrounding vessels that she was not under command and as a result when the change in heading was detected by Gortynia, at a very late stage, this did not allow her to take effective avoiding action in time to avoid the collision.

The Marine Safety Investigation Unit (MSIU) has made a number of recommendations to Eastern Mediterranean Maritime Ltd, the managers of Gortynia, aimed at addressing safety of navigation on board vessels under its management.

During the course of the safety investigation, the MSIU had very limited information on DZ Qingdao, her crew members and the dynamics leading to the collision with Gortynia. To this effect, the MSIU was unable to analyse and report on a more detailed operational context and perhaps enhance the possibility of preventing similar future accidents by making recommendations to the managers of DZ Qingdao.
## 1 FACTUAL INFORMATION

### 1.1 Vessel, Voyage and Marine Casualty Particulars

<table>
<thead>
<tr>
<th>Name</th>
<th>Gortynia</th>
<th>DZ Qingdao</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flag</td>
<td>Malta</td>
<td>Liberia</td>
</tr>
<tr>
<td>Classification Society</td>
<td>Bureau Veritas</td>
<td>Korean Register of Shipping</td>
</tr>
<tr>
<td>IMO Number</td>
<td>9702584</td>
<td>9116656</td>
</tr>
<tr>
<td>Type</td>
<td>Bulk carrier</td>
<td>Bulk carrier</td>
</tr>
<tr>
<td>Registered Owner</td>
<td>Premier Shipholdings Co Ltd</td>
<td>DZ Qingdao Shipping Corp Ltd</td>
</tr>
<tr>
<td>Managers</td>
<td>Eastern Mediterranean Maritime Ltd</td>
<td>Sea Ray Shipping Co Ltd</td>
</tr>
<tr>
<td>Construction</td>
<td>Steel (Double bottom)</td>
<td>Steel (Double bottom)</td>
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<tr>
<td>Length overall</td>
<td>292.00 m</td>
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<td>Registered Length</td>
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<td>27,763</td>
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<td>Minimum Safe Manning</td>
<td>15</td>
<td>Not available</td>
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<tr>
<td>Authorised Cargo</td>
<td>Dry bulk</td>
<td>Dry bulk</td>
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<td>Port of Departure</td>
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<td>Port of Arrival</td>
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<td>Type of Voyage</td>
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<tr>
<td>Cargo Information</td>
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<tr>
<td>Manning</td>
<td>22</td>
<td>Not available</td>
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<tr>
<td>Date and Time</td>
<td>17 May 2017 at 0030 (LT)</td>
<td></td>
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<tr>
<td>Type of Marine Casualty</td>
<td>Serious Marine Casualty</td>
<td>Serious Marine Casualty</td>
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<tr>
<td>Place on Board</td>
<td>Forecastle, Freeboard Deck</td>
<td>Forecastle, Freeboard Deck</td>
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<tr>
<td>Injuries/Fatalities</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Damage/Environmental Impact</td>
<td>Structural damage to the bow</td>
<td>Structural damage to the bow</td>
</tr>
<tr>
<td>Ship Operation</td>
<td>Normal Service / In passage</td>
<td>Normal Service / In passage</td>
</tr>
<tr>
<td>Voyage Segment</td>
<td>Transit</td>
<td>Transit</td>
</tr>
<tr>
<td>External &amp; Internal Environment</td>
<td>Good visibility. Light Southeasterly breeze with slight seas</td>
<td></td>
</tr>
<tr>
<td>Persons on Board</td>
<td>22</td>
<td>Not available</td>
</tr>
</tbody>
</table>
1.2 Description of Vessels

1.2.1 MV Gortynia
The Maltese registered Gortynia (Figure 1) is a cape size bulk carrier, built in 2015 by Japan Marine United Ariake Shipyard. The vessel is classed by Bureau Veritas (BV) for unrestricted navigation.

![Figure 1: MV Gortynia](image)

Gortynia is owned by Premier Shipholdings Co. Ltd. and the technical management is carried out by Eastern Mediterranean Maritime Ltd., based in Piraeus, Greece. The Company owns and operates 61 vessels under the Maltese flag.

Gortynia has nine cargo holds, of which, nos. 1, 3, 5, 7 and 9 are strengthened for alternate cargo hold loading. Her gross tonnage (GT) is 93,297 and net tonnage is 58,940. The vessel has a length overall of 292.0 m and a beam of 45.0 m. Her depth
is 24.55 m and the maximum deadweight is 182,608 tonnes at a summer draught of 18.18 m. A General Arrangement Plan can be found at Figure 2.
Gortynia’s propulsive power is provided by 2 stroke, single acting, 7-cylinder MAN-B&W medium speed diesel engine, producing 15,860 kW. The vessel has one fixed pitch propeller and her service speed is 15.5 knots\(^1\).

The vessel is traded by her managers on the bulk ore trade usually between Brazil and the Far East or between Australia and the Far East.

1.2.2 Bridge layout and equipment

Gortynia was equipped with the required navigation equipment as listed on her Record of Equipment for Cargo Ship Safety Equipment Certificate - Form E.

The main equipment included the following:

- two Global Positioning Systems (GPS);
- gyro and magnetic compasses;
- two radars – S and X-Band with automatic radar plotting aid (ARPA);
- automatic Identification System (AIS);
- Bridge Navigation Watch Alarm System (BNWAS);
- automatic pilot;
- echo sounder;
- Voyage Data Recorder (VDR); and
- electronic chart display and information system (ECDIS).

The main navigation consoles, located either side of the main steering console housed two radars and an ECDIS on the starboard side (Figure 3) and the port side console house an ECDIS and the main engine controls.

\(^1\) One knot is equal to 1.852 kmhr\(^{-1}\).
The hand steering position is located midship in line with the navigation and engine control panel (Figure 3). The vessel’s primary means of navigation was ECDIS. The bridge layout was spacious. Although not used during navigation, the chartroom was an integral part of the bridge, fitted behind the starboard navigation instrument console (Figure 4 and 5). The main GMDSS station is situated within the bridge area, but on the starboard aft side.

Figure 3: Bridge layout

Figure 4: Radar sets and ECDIS located on the starboard side
At the time of the collision, all the navigational equipment was reported to be operating satisfactorily.

1.2.3 MV DZ Qingdao

The Liberian registered DZ Qingdao is a 27,763 gt bulk carrier, owned by DZ Qingdao Shipping Corp Ltd., located in China. The vessel is managed by Sea Ray Shipping Co Ltd. The vessel was built in 1996 by Oshima Shipbuilding Company, Japan and is classed by the Korean Register of Shipping. DZ Qingdao is classed as a handy sized bulk carrier and has five cargo holds and four deck cargo cranes. Propulsive power is provided by a 6-cylinder B&W 6S50MC, two-stroke, medium speed diesel engine, producing 6,650 kW at 100 rpm. This drives a fixed pitch propeller to give a service speed of about 14.50 knot.

The MSIU was unable to gain access to the crew of DZ Qingdao and therefore, not much is known except that she was on a ballast voyage from Tianjin, China to Port Kelang, Malaysia when the collision occurred. Similarly, there is no information on the composition of the bridge team.
1.3 Manning and Crewing

*Gortynia* was manned with a crew of 22 officers and ratings, all of which were Filipino nationals. At the time of the accident, the vessel was manned in excess of the Minimum Safe Manning Document issued by the flag State Administration. The crew had been supplied by Bernard Schulte Management (BSM) under a crew management contract to Eastern Mediterranean Maritime Ltd. The working language on board was English.

As the vessel was manned with three navigating officers excluding the master, the watchkeeping hours were divided between the three officers on a '4-on, 8-off' basis. Although the master did not keep a navigational watch, he was on call at all times.

1.3.1 Master

The master was 59 years old and had been at sea for the past 30 years. He obtained his Master’s Certificate of Competency in 1993 and had revalidated his license in July 2015 for another five years. The master had an 'Endorsement Attesting the Recognition of a Certificate' from Transport Malta’s Merchant Shipping Directorate dated 31 March 2017.

The master has been sailing in this rank since 2003 and his experience has mainly been on bulk carriers. This was his first contract with the technical managers. He had joined the vessel on 25 January 2017 in Singapore.

1.3.2 Chief mate (4-8)

The chief mate was 48 years old and had 25 years of seagoing experience. He obtained his Master’s Certificate of Competency in 2011. He had an 'Endorsement Attesting the Recognition of a Certificate' from Transport Malta’s Merchant Shipping Directorate dated 6 September 2016.

This was the chief mate’s first contract with Eastern Mediterranean Maritime Ltd. He has been in the present rank for the last 10 years and had joined the vessel on 03 April 2017 in Singapore.
1.3.3 Second mate (12-4)
The second mate was 42 years old and had 13 years of sea experience. He had obtained his STCW II/1 (OOW) Certificate of Competency in 2007 and had an 'Endorsement Attesting the Recognition of a Certificate' from Transport Malta’s Merchant Shipping Directorate dated 14 February 2017.

The second mate had been in rank for the past four years, of which the last two years being served with BSM. He had joined the vessel on 01 December 2016 in Saldanha Bay.

1.3.4 Cadet
This was the cadet’s first trip at sea. He had just joined the vessel on 23 March 2017 in Jingtang, China. At the time of the accident, he had only completed his basic training STCW VI/1.

1.3.5 Helmsman (12-4)
The helmsman was 35 years old and had seven years of seagoing experience. He had an Able Bodied Seaman’s (AB) certificate enabling him to be a ‘Rating Forming Part of a Navigational Watch’. The certificate had been issued on 20 February 2015 by the Republic of the Philippines. He had working with BSM for six years and this was his first contract with Eastern Mediterranean Maritime Ltd.

All of the bridge watch keeping officers, bar for the cadet had attended an ECDIS and Bridge Team Management courses.

1.4 Environment

On 16 May 2017 at 2400, i.e., when the third mate handed over the watch to the second mate, the environmental conditions recorded in the deck log book were as follows:

- Wind speed: Beaufort 3;
- Wind direction: Southeast;
- Visibility: Good.
1.5 Narrative

1.5.1 Background

_Gortynia_ departed Saldanha Bay, South Africa at 1400 on 26 April 2017. The vessel had loaded 179,554 mt of iron ore bound for China. Her departure draughts were 18.07 m forward, and 18.17 m aft.

Since the vessel was scheduled to stop at Singapore, the master followed a passage plan that took the vessel past One Fathom Bank into the Malacca Strait and Singapore.

In anticipation of increased traffic conditions and the deep draught of the vessel, the master doubled up the watches just before the vessel arrived off One Fathom Bank on 16 May 2017.

The watch schedule was adjusted to:

- 0000 - 0600/1200 - 1800 chief mate and second mate;
- 0600 - 1200/1800 - 2400 master and third mate.


1.5.2 Events on board _Gortynia_ leading up to the collision

At about 2000 on 16 May, the main engine was set to standby and the Master took the con of the vessel. End of sea passage was rung at 2100 when the vessel was approximately abeam of ‘The Brothers’ light, about one nautical mile prior to the vessel’s exit from the Malacca Strait traffic separation scheme (TSS). In addition to the master, the third mate and an AB were present on the bridge. Helm was changed over from automatic to manual. The cadet joined the bridge team at 2200 to assist with look-out duties. _Gortynia_ was bound for pilot Eastern Boarding Ground ‘B’ (PEBGB).

At about 2249, _Gortynia_ entered the deep water route in the Singapore main strait TSS and at 2258, her engine was set at full ahead (manoeuvring). The vessel’s speed\(^3\) was 10.1 knots.

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\(^2\) The clocks on board were maintained on UTC + 8.

\(^3\) Speed over ground (SOG).
At 0000 on 17 May, the chief mate and the second mate took over the watch from the third mate. The AB on the wheel was also relieved and the vessel continued to be manually steered. The chief mate was tasked with anti-collision duties and the position fixing and monitoring the vessel’s planned track was delegated to the second mate. The master retained the con of the vessel and along with the cadet remained on the bridge. The estimated time of arrival (ETA) to PEBGB was 0100 and the traffic in the immediate vicinity was heavy (Figure 6).

![Figure 6: Gortynia’s radar screen showing her in the deep water route at 0000](image)

At about 0015 *DZ Qingdao* and *African Loon* were noticed by the chief mate on the S-band radar that he was monitoring on 3 nautical mile (nm) range. He acquired both targets in the AIS mode (Figure 7).
Figure 7: DZ Qingdao’s target acquired by chief mate

Gortynia’s heading and speed was 068.4° and 8.6 knots respectively. DZ Qingdao was about 4.4 nm distant. The subsequent AIS plot of African Loon at 0016 indicated that it would pass Gortynia at about 4 cables on the port side and it was assumed by the chief mate that DZ Qingdao would also pass clear as both vessels were following each other in the West bound traffic lane. At the same time, Malacca Star was overtaking Gortynia on her starboard side with a closest point of approach (CPA) of about four cables.

At about 0020, DZ Qingdao was about 2.9 nm distant and the vessel’s AIS vectors continued to indicate that it would pass clear of Gortynia (Figure 8).
At 0022:05, *Malacca Star* called Vessel Traffic Information System (VTIS) Central\(^4\) on VHF radio and advised them of their intentions:

*I will be crossing TSS to proceed to pilot boarding ground alpha over*

VTIS central acknowledged that and advised *Malacca Star*:

*Sir, please, let the deep draft vessel\(^5\) know that you are crossing sir, you are very close to her*

At about 0022, the AIS vector on *DZ Qingdao* disappeared\(^6\) (Figure 9). The AIS symbol (triangle) reappeared around 0023 but had an incorrect heading and no directional vector (Figure 10).

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\(^4\) Verbatim transcript of VHF recorded by VTIS provide by Maritime and Port Authority of Singapore (MPA).

\(^5\) *Gortynia*

\(^6\) The AIS data recorded by the VDR indicated that it received no AIS signal from *DZ Qingdao* from 0021:25 to 0023:19 - a duration of about 1 minute 55 seconds.
Figure 9: AIS vector of *DZ Qingdao* disappeared

Figure 10: AIS symbol reappeared but no vector.
At 0022:52 VTIS central called Gortynia:

*Gortynia Gortynia did you copy that, the container ship Malacca Star intends to cross the channel now over*

This was duly acknowledged by Gortynia at 0023:26.

At 0026:52 VTIS Central called *DZ Qingdao* and advised them that:

*You are observed to be coming in to the deep water route, can you please go back into the west bound lane as soon as you can*

This message was acknowledged by *DZ Qingdao* at 0027:08 when Gortynia was about six cables distant (Figure 11).

![Figure 11: DZ Qingdao at 0027, about six cables distant](image)

Soon afterwards, at about 0027:22, the bridge team members on board Gortynia became aware of *DZ Qingdao* heading towards them. The master initially ordered the engine to ‘half ahead’ at 0027:29 and the helm to starboard 20° at 0028:04, followed by ‘dead slow ahead’ and wheel amidships.
Although not heard clearly on *Gortynia*’s VDR playback, it appeared that *DZ Qingdao* attempted to alert *Gortynia* over the VHF by asking the vessel to keep clear of them.

At 0028:39, *Gortynia*’s master ordered ‘stop engine’ and a few seconds later ordered the wheel to hard to starboard. The master subsequently ordered that the main engine is progressively set to ‘full astern’, but this did not prevent both vessels from colliding with each other at about 0029:12 in position 01° 11.66’ N 103° 51.64’ E (Figure 12). The two vessels remained in contact with each other for about a minute, causing extensive damage to the respective structures.

![Figure 12: Collision](image)

A one-minute interval plot of both vessels from 0014 to 0029 can be seen in Figure 13.
Figure 13: Collision plot on extract of BA Chart 4041
1.5.3 Post collision events on board Gortynia

Following the collision, the master reported the collision to VTIS at 0031. He then concentrated his efforts in controlling the vessel’s movements and avoid the shallow waters off Batu Berhanti (Figure 14). The vessel avoided running aground but cleared the bank at about 0040.

![Vessel's track following the collision with DZ Qingdao](image)

The master then instructed the chief mate to check the vessel for any water ingress into the cargo holds, ballast tanks and engine-room. Due to the extreme noise generated by the collision, all of the crew were awake. The master was advised by VHF that all were accounted for and no one had been injured. The master completed the ‘Collision Checklist’ contained in the safety management system (SMS) and subsequently contacted the vessel’s technical managers.

The pilot boarded at 0151 and the vessel anchored safely at 0340 in position 01° 6.7’ N 103° 59.7’ E, in the Eastern anchorage ‘Bravo’.
1.5.4 Events on board DZ Qingdao

As previously mention in section 1.2.3, the MSIU had no access to the vessel and therefore are unaware of the dynamics of the events that evolved on board. It is known, however, that the vessel suffered a total power failure that probably resulted in a steering gear failure. However, the events recorded on Gortynia’s VDR have provided the safety investigation with adequate information to reach a meaningful analysis.

1.6 Damage to Gortynia

Gortynia sustained extensive damage to her hull in way of port side ballast tank no. 1, which included:

- breach of the upper topside tank and double bottom (Figures 15 and 16);
- cracks in the side shell plating, in way of cargo holds nos. 1 and 2;
- buckling of the shell plating and fish plate extending from frames nos. 41 to 263;
- deformation of web frames in way of the above mentioned damage;
- damage to deck railings and fittings at various locations (port side);
- damage to the hatch cover opening railway (port side);
- damage to various ballast and fuel oil tanks vent heads; and
- fuel oil hose handling davits (port side).

![Figure 15: Damaged areas to Gortynia, in way of port side ballast tank no. 1](image-url)
1.7 Damage to *QZ Qingdao*

The exact extent of damage sustained by *DZ Qingdao* is not known. However, judging from the angle at which both vessels collided and the section of bow, anchor and anchor chain found on board *Gortynia* (Figure 17), the damage was extensive.

Figure 16: Point of contact and extreme damage section on *Gortynia* (port side)

Figure 17: Damaged section of *DZ Qingdao*’s bow on *Gortynia*’s deck
1.8 The Singapore Strait

Both the Singapore Strait and Singapore port waters are two of the busiest areas in the world and therefore a Mandatory Ship Reporting System is used. This system covers the Straits of Malacca and Singapore and is known as STRAITREP\textsuperscript{7}, which has been in operation since 1998. The operational area of STRAITREP covers the straits between longitudes $100^\circ\ 40'$ N $104^\circ\ 23'$ E (Figure 18).

![Figure 18: Coverage of the STRAITREP](image)

The objectives of the STRAITREP are to:

- enhance the safety of navigation;
- protect the marine environment;
- facilitate the movements of vessels; and
- support SAR and oil pollution response operations advanced VTS.

The monitoring of safe and efficient navigation of ships in Singapore straits TSS is undertaken by Singapore’s VTIS, operated by the MPA, covering sectors 7 to 9.

\textsuperscript{7} As required by regulation V/8-1(h) of the International Convention of the Safety of Life at Sea, 1974, as amended (SOLAS Convention).
2 ANALYSIS

2.1 Purpose

The purpose of a marine safety investigation is to determine the circumstances and safety factors of the accident as a basis for making recommendations, to prevent further marine casualties or incidents from occurring in the future.

2.2 Fatigue and Alcohol

The bridge team on board Gortynia reported as being well rested at the time of the incident. The hours of rest records were in order and showed that rest hours were in excess of those required by STCW or the Maritime Labour Convention. Although there were no records of hours of (quality) of sleep, there were no indications of any signs of fatigue.

Alcohol tests were carried out shortly after the accident on all crew members who were on duty at the time, including the master. All tests results were negative and therefore fatigue and alcohol were not considered to be a contributing factors to this collision.

2.3 Overview of the Collision Dynamics

There were a number of significant events leading up to the collision between Gortynia and DZ Qingdao. Underpinning them were issues linked to the conduct of navigation by the bridge team of Gortynia, which will be discussed in subsequent sections of this safety investigation report.

The collision between Gortynia and DZ Qingdao occurred because although the bridge team on board Gortynia had been doubled, in recognition of transiting a very busy waterway, the perception of the developing situation which the crew members on the bridge had, did not reflect the situation outside the bridge window.

Following the total power failure on board DZ Qingdao, Gortynia’s bridge team was neither unaware of the risk of collision which had developed with a vessel that was
initially going to pass clear, nor of the immediate avoiding action which was required to avoid the two vessels from colliding.

2.4 **Look-out**

The cornerstone in complying with the COLREGS and determining what next action is required to avoid a collision, is Rule 5. If there is no look-out, many of the regulations intended to prevent collisions in varying circumstances cannot be applied. This Rule requires that a proper look-out is maintained at all times by ‘sight and by hearing as well as by all available means appropriate’. In practical terms, a look-out by sight means either a member of the bridge team physically sighting the vessel, the use of radar, and/or AIS to determine the presence of another vessel in the vicinity. A lookout by ‘hearing’ constitutes the monitoring of VHF radio conversation and or any signals sounded by another vessel in the vicinity.

The chief mate had sighted *DZ Qingdao* and *African Loon* at 0015 (Figure 7), on the radar and plotted them and established that they would safely pass on the vessel’s port side. However, the bridge team thereafter did not continue to monitor *DZ Qingdao*’s track. There were two missed opportunities that could have alerted them to *DZ Qingdao*’s change in heading. The first one was when the AIS vector disappeared at around 0022 (Figure 9); this was not investigated. The second opportunity was at around 0024 when the *DZ Qingdao*’s track trail distinctly indicated on the radar screen that the vessel’s heading had changed (Figure 19).

In addition to the change of track trail, around this time there would have been a distinct change in the aspect of the vessel and a transition in the navigation lights side lights, from red to green. This was also not investigated by the bridge team. Although the safety investigation did not exclude the possibility that the backscatter of lighting in Singapore Strait could have possibly hindered the keeping of a look-out, no such difficulty was reported by the bridge team.
Figure 19: Radar screen at 0024 showing change of heading in *DZ Qingdao* trail

*Gortynia* was navigating within an area monitored by VTIS and was therefore required to keep a listening watch on the nominated radio channel (Channel 14). At about 0027, VTIS central advised *DZ Qingdao* that she was observed to be coming in to the deep water route. It would appear that *Gortynia*’s bridge team did not recognize the significance of this conversation or any subsequent conversation between VTIS and *DZ Qingdao*. The crew members were also unaware of *DZ Qingdao*’s broadcasts of “alter alter please keep clear” in the two minutes leading up to the collision. Although *DZ Qingdao*’s broadcasts were incoherent and not clear, they along with VTIS transmissions did not alert the bridge team that the situation has changed to an extent that some intervention was required.
2.5 Assessing the Risk of Collision

Although the chief mate acquired the two targets (*DZ Qingdao* and *African Loon*) at about 0015, he acquired them on radar using the AIS function. When *DZ Qingdao* suffered a power failure, the power to its AIS equipment was temporarily disrupted, which led to the loss of the AIS vector being displayed from about 0020 to about 0027 when it was manually re-acquired. Since the vessel was not using the ARPA facility, the display of vectors was interrupted because of the blackout and consequently, the crew members on *Gorthynia* were not alerted of the developing situation.

It would appear that the bridge team had a preference for interrogating AIS targets on the radar display for anti-collision purposes. The safety investigation is of the view that at present, the use of AIS is not advocated in the COLREGS. However, the purpose of AIS is to help identify ships, assist in target tracking, assist in search and rescue operation, simplify information exchange and provide additional information to assist situation awareness of traffic conditions. The AIS supports (rather than replaces) radar tracking, by assisting in collision decision making. It is an additional source of navigational information but does not replace navigational systems such as radar target tracking.

There are some distinct advantages in using AIS data for collision avoidance where:

- changes in heading and speed are readily apparent;
- targets are not lost in clutter, or through target swap or fast vessel manoeuvres; and
- a target’s name and/or call sign and status are readily identified.

IMO Resolution A.1106(29) (Annex I) cautions on the reliance of AIS in that:

- not all ships carry AIS;
- the officer of the watch (OOW) should always be aware that other ships, in particular leisure crafts, fishing boats and warships, and some coastal shore stations including Vessel Traffic Services centres, might not be fitted with AIS; and

---

8 This was observed during the VDR playback.
• the OOW should always be aware that AIS fitted on other ships as a mandatory carriage requirement might, under certain circumstances, be switched off on the master’s professional judgement.

While there is a case for using both AIS and ARPA for anti-collision manoeuvres, total reliance on either one could be hazardous because both are prone to errors. It can also engender a misperception that only targets with AIS symbols warrant interrogation, with all other targets on the radar display being ignored, without determining if they actually pose a danger.

The MSIU is of the view that an increased reliance on AIS plotting led the bridge team to miss out on vital information, which could have provided a clearer picture on the way the situation was developing.

2.6 Navigating in Busy Waterways

The difficulty of navigating in congested and narrow waterways is that passing distances between vessels are drastically reduced to distances of less than a mile or cables, in some cases. These passing distances rely on both vessel navigating in accordance with the COLREGs, and that their main engine and steering is fully functional.

Although not known at the time, the safety investigation established that the loss of AIS symbol was due to a total power failure on board DZ Qingdao. This, in turn, rendered the vessel’s steering ineffective and therefore she became a ‘vessel not under command’⁹, which meant that through some exceptional circumstances, she was unable to manoeuvre as required by the COLREGs and therefore unable to keep out of the way of Gortynia.

The period between when the steering loss could have been detected (about 0024) and the time of collision was very short (about 5 minutes). In order to avoid a collision, avoiding action had to be taken sometime soon after 0024 for it to have been effective. Even though Gortynia was proceeding at a safe speed (Rule 6), the resulting action taken to avoid a collision by the master, at a later stage, was

⁹ COLREGs, Rule 3(f).
ineffective because of the vessel’s large size and deep draught, which restricted her manoeuvrability.

Situations where a vessel develops a problem with its main engine or steering may be relatively rare; however, the threat of something happening is ever present. Therefore, it is vital that on-coming traffic is closely monitored and continued to be monitored until the other vessel is finally past and clear. Only by doing so will a bridge team be able to detect a developing situation early and respond accordingly to the situation

2.7 Bridge Team Management

The bridge on board *Gortynia* was adequately manned for the intended transit through Singapore Strait. In fact, the bridge team had been strengthened by the inclusion of the chief mate for the critical part of the passage. However, a developing situation remained unidentified.

Evidence indicated that *Gortynia*’s bridge team only became aware of *DZ Qingdao* when they heard a sound signal emitted by her at a very close range of about six cables. Given that *Gortynia* was 289 m long, this effectively meant that she was about four cables away or even less. As mentioned in section 2.4, the bridge team neither spotted that the AIS symbol over her target had disappeared at around 0022, nor that *DZ Qingdao* had altered towards her around 0024.

The MSIU believes that the reasons for the missed information was distraction. Although the bridge team had functioned well up until that time, the tone of the conversations recorded on the VDR suggested a casual atmosphere and an animated discussion was taking place. This probably had deviated the chief mate’s attention, who had been tasked with anti-collision duties. Notwithstanding the above, the change of *DZ Qingdao*’s aspect and her side lights was also missed by the other team members at 0024.

The safety investigation is of the view that another distraction occurred at about 0022 when a conversation between VTIS and *Malacca Star* occurred just about the time when the AIS signal from *DZ Qingdao* disappeared. Around this time, *Malacca Star*
had just overtaken *Gortynia* on her starboard side and was less than five cables away. It was likely that the bridge team’s attention was focused on the starboard side due to the close proximity of the vessel and therefore missed this opportunity to notice *DZ Qingdao* heading towards them.

The bridge team missed another event around 0026:52 when VTIS notified *DZ Qingdao* that she was entering the deep water route. It was evident that the bridge team missed this critical development. The level of conversation taking place on the bridge at the time would not have made it possible to effectively maintain a proper aural lookout.

**2.8 Post Collision Actions**

Following the collision, the master concentrated his efforts in regaining control of the vessel and place her in a safe position, which he did. He then shifted his to the requirements of the emergency checklist. Although the master did not sound the general alarm or muster the crew, he was aware that all crew had been accounted for and directed his crew in establishing the damage sustained to the vessel.

Following initial reports that ballast tanks nos. 1 (double bottom and top side tank) had flooded, the master contacted the owners so that they could seek assistance from the ‘Emergency Response Service’ provided by the vessel’s classification society. The master subsequently received information confirming that although the vessel’s hull had been breached, she had sufficient residual strength and adequate reserve buoyancy to remain in a safe position at the anchorage. This allowed the master to focus on mitigating the damage to his vessel and cargo, as well as plan temporary repairs to the breached hull.

**2.9 Actions on board *DZ Qingdao***

As previously mentioned, the MSIU had access neither to the vessel nor her records. However, in view that *DZ Qingdao* suffered a total power failure, there were a number of actions which do not appear to the MSIU that had been taken.
When *DZ Qingdao* suffered a loss of power around 0022, she in effect became a ‘vessel not under command’ within the meaning of the COLREGS.

*DZ Qingdao*’s deviation was noted by VTIS at around 0026:52 who then advised the vessel that she was observed to be entering the deep water route. *DZ Qingdao*, instead of advising the VTIS and the surrounding vessels that she was not under command, simply acknowledged the transmission by stating “OK, copy ma’am, thank you for information…,” suggesting that the vessel was under control and that she would take corrective action to avoid coming into the deep draft water lane. A VHF announcement from *DZ Qingdao*, in addition to displaying the required signals, would have made it clear that she was not under command.

The MSIU believes that although the vessel suffered a total power failure, it should have had an emergency source of electrical power, as required by SOLAS regulation II-1/43. This source could also have powered the not under command lights, which could have alerted *Gortynia* and surrounding vessels of her predicament as well as being a requirement in fulfilling the COLREGS. This source could have also powered the Aldis Lamp to attract the attention at an early stage.
THE FOLLOWING CONCLUSIONS AND RECOMMENDATIONS SHALL IN NO CASE CREATE A PRESUMPTION OF BLAME OR LIABILITY. NEITHER ARE THEY BINDING NOR LISTED IN ANY ORDER OF PRIORITY.
3 CONCLUSIONS

Findings and safety factors are not listed in any order of priority.

3.1 Immediate Safety Factor

.1 The perception of the developing situation which the crew members on the bridge of Gorthinia had, did not reflect the situation outside the bridge window.

.2 When VTIS advised DZ Qingdao that they were entering the deep water route, instead of advising the Centre and the surrounding vessels that she was not under command, the crew members acknowledged the transmission thereby suggesting that the vessel was under control and that she would take corrective action.

3.2 Latent Conditions and other Safety Factors

.1 DZ Qingdao was a vessel not under command but did not display the appropriate signals;

.2 Following the total power failure on board DZ Qingdao, Gortynia’s bridge team was neither unaware of the risk of collision which had developed with a vessel that was initially going to pass clear, nor of the immediate avoiding action which was required to avoid the two vessels from colliding;

.3 The bridge team thereafter did not continue to monitor DZ Qingdao’s track after the vessel was visually sighted;

.4 The AIS vector disappeared at around but this was not investigated;

.5 DZ Qingdao’s track trail distinctly indicated on the radar screen that the vessel’s heading had changed but this was also not investigated by the crew members;

.6 Distinct change in the aspect of the vessel and a transition in the navigation lights side lights, from red to green were also not investigated by the bridge team;
Gortynia’s bridge team only became aware of DZ Qingdao when they heard a sound signal emitted by her at a very close range of about six cables;

The reasons for the missed information was distraction;

3.3 Other Findings

Fatigue and alcohol were not considered to be a contributing factors to this collision.
4 RECOMMENDATIONS

In view of the conclusions reached and taking into consideration the safety actions taken during the course of the safety investigation,

Eastern Mediterranean Ltd. is recommended to:

11/2018_R1 review the lessons highlighted in this investigation and circulate to all vessels in the fleet;

11/2018_R2 review the procedures on collision avoidance and reinforce the requirement of radar plotting by ARPA rather than reliance on AIS;

11/2018_R3 review the procedures on collision avoidance and reinforce the requirement of radar plotting by ARPA;

11/2018_R4 review their bridge team management and training in light of the findings highlighted in this investigation;

11/2018_R5 undertake a series of navigation audits on board its managed vessels to ensure company bridge requirements and procedures are being carried out.
ANNEXES

Annex 1     IMO Resolution A.1106(29)
THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety,

RECALLING ALSO the provisions of regulation V/19 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, requiring all ships of 300 gross tonnage and upwards engaged on international voyages, cargo ships of 500 gross tonnage and upwards not engaged on international voyages and passenger ships irrespective of size to be fitted with an automatic identification system (AIS), as specified in SOLAS regulation V/19.2.4, taking into account the recommendations adopted by the Organization,

RECALLING FURTHER resolution A.917(22), as amended by resolution A.956(23), by which it adopted Guidelines for the onboard operational use of shipborne automatic identification systems (AIS),

HAVING CONSIDERED the recommendations made by the Maritime Safety Committee at its ninety-fourth session,

1 ADOPTS the Revised guidelines for the onboard operational use of shipborne automatic identification systems (AIS), set out in the annex to the present resolution;

2 INVITES Governments concerned to take into account the annexed revised guidelines when implementing SOLAS regulations V/11, 12 and 19;

3 ALSO INVITES Governments which are considering setting or have set regional frequencies or otherwise make use of AIS channel management, including changing to narrow-band operation for whatever reason, to take into account the possible impact on the use of AIS at sea and that it should only be used for urgent temporary situations. In such cases Governments should notify the Organization of such areas and designated frequencies, for urgent circulation of that information to all Member Governments;
4 REQUESTS the Maritime Safety Committee to keep the revised guidelines under review and amend them as appropriate;

5 REVOKES resolution A.917(22), as amended by resolution A.956(23).
Annex

REVISED GUIDELINES FOR THE ONBOARD OPERATIONAL USE OF SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEMS (AIS)

PURPOSE

1. These Guidelines have been developed to promote the safe and effective use of shipborne Automatic Identification Systems (AIS), in particular to inform the mariner about the operational use, limits and potential uses of AIS. Consequently, AIS should be operated taking into account these Guidelines.

2. Before using shipborne AIS, the user should fully understand the principle of the current Guidelines and become familiar with the operation of the equipment, including the correct interpretation of the displayed data. A description of the AIS system, particularly with respect to shipborne AIS (including its components and connections), is contained in annex 1.

CAUTION

Not all ships carry AIS.

The officer of the watch (OOW) should always be aware that other ships, in particular leisure craft, fishing boats and warships, and some coastal shore stations including Vessel Traffic Service (VTS) centres, might not be fitted with AIS.

The OOW should always be aware that AIS fitted on other ships as a mandatory carriage requirement might, under certain circumstances, be switched off on the master’s professional judgement.

3. The internationally-adopted shipborne carriage requirements for AIS are contained in SOLAS regulation V/19. The SOLAS Convention requires AIS to be fitted on certain ships through a phased implementation period spanning from 1 July 2002 to 1 July 2008. In addition, specific ship types (e.g. warships, naval auxiliaries and ships owned/operated by Governments) are not required to be fitted with AIS. Also, small ships (e.g. leisure craft, fishing boats) and certain other ships may be exempt from carrying AIS. Moreover, ships fitted with AIS might have the equipment switched off. Users are therefore cautioned always to bear in mind that information provided by AIS may not be giving a complete or correct “picture” of shipping traffic in their vicinity. The guidance in this document on the inherent limitations of AIS and their use in collision avoidance situations (see paragraphs 40 to 44) should therefore be observed.

Objectives of AIS

4. AIS is intended to enhance: safety of life at sea; the safety and efficiency of navigation; and the protection of the marine environment. SOLAS regulation V/19 requires that AIS exchange data ship-to-ship and with shore-based facilities. Therefore, the purpose of AIS is to help identify ships, assist in target tracking, assist in search and rescue operation, simplify information exchange (e.g. reduce verbal mandatory ship reporting) and provide additional information to assist situation awareness. In general, data received via AIS will improve the quality of the information available to the OOW, whether at a shore surveillance station or on board a ship. AIS is a useful source of supplementary information to that derived from navigational systems (including radar) and therefore an important ‘tool’ in enhancing situation awareness of traffic confronting users.
DESCRIPTION OF AIS

5 Class A shipborne equipment complies with relevant IMO AIS carriage requirement. Class B shipborne equipment provides functionalities not in full accordance with IMO AIS carriage requirement. Class B devices may be carried on ships which are not subject to the SOLAS carriage requirements.

6 Shipborne AIS (see figure 1):
   - transmits ship's own data to other ships and vessel traffic service (VTS) stations; and
   - receives and makes available data of other ships and VTS stations and other AIS stations, such as AIS-SARTs, AIS-ATON, etc.

7 When used with the appropriate display, shipborne AIS enables provision of fast, automatic information by calculating Closest Point of Approach (CPA) and Time to Closest Point of Approach (TCPA) from the position information transmitted by the target vessels.

8 AIS operates primarily on two dedicated VHF channels. Where these channels are not available regionally, the AIS is capable of being automatically switched to designated alternate channels by means of a message from a shore facility. Where no shore-based AIS or Global Maritime Distress and Safety System (GMDSS) Sea Area A1 station is in place, the AIS should be switched manually. However, this capability should only be considered for use in urgent, temporary situations, noting the possible adverse effects on AIS at sea.

9 The capacity of the system allows for a great number of ships to be accommodated at the same time. Priority in the system is given to Class A devices. Class B devices operate at a reduced reporting rate or when free time slots are available.
10 The AIS is able to detect ships within VHF/FM range around bends and behind islands, if the landmasses are not too high. A typical value to be expected at sea is 20 to 30 nautical miles depending on antenna height. With the help of repeater stations, the coverage for both ship and VTS stations can be improved.

11 Information from a shipborne AIS is transmitted continuously and automatically without any intervention or knowledge of the OOW. An AIS shore station might require updated information from a specific ship by "polling" that ship, or alternatively, might wish to "poll" all ships within a defined sea area. However, the shore station can only increase the ships' reporting rate, not decrease it.

**AIS INFORMATION SENT BY SHIPS**

**Ship's data content**

12 The AIS information transmitted by a ship is of three different types:

- static information, which is entered into the AIS on installation and need only be changed if the ship changes its name, Maritime Mobile Service Identity (MMSI), location of the electronic position fixing system (EPFS) antenna, or undergoes a major conversion from one ship type to another;

- dynamic information, which, apart from "Navigational status" information, is automatically updated from the ship sensors connected to AIS; and

- voyage-related information, which might need to be manually entered and updated during the voyage.

13 Details of the information referred to above are given in table 1 below:

<table>
<thead>
<tr>
<th>Information item</th>
<th>Information generation, type and quality of information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Static</strong></td>
<td></td>
</tr>
<tr>
<td>MMSI</td>
<td>Set on installation</td>
</tr>
<tr>
<td></td>
<td>Note that this might need amending if the ship changes ownership</td>
</tr>
<tr>
<td>Call sign and name</td>
<td>Set on installation</td>
</tr>
<tr>
<td></td>
<td>Note that this might need amending if the ship changes ownership</td>
</tr>
<tr>
<td>IMO Number</td>
<td>Set on installation</td>
</tr>
<tr>
<td>Length and beam</td>
<td>Set on installation or if changed</td>
</tr>
<tr>
<td>Type of ship</td>
<td>Select from pre-installed list</td>
</tr>
<tr>
<td>Location of electronic position fixing system (EPFS) antenna</td>
<td>Set on installation or may be changed for bi-directional vessels or those fitted with multiple antennas</td>
</tr>
<tr>
<td>Dynamic</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ship's position with accuracy indication and integrity status</td>
<td>Automatically updated from the position sensor connected to AIS</td>
</tr>
<tr>
<td></td>
<td>The accuracy indication is approximately 10 m.</td>
</tr>
<tr>
<td>Position Time stamp in UTC</td>
<td>Automatically updated from ship's main position sensor connected</td>
</tr>
<tr>
<td></td>
<td>to AIS</td>
</tr>
<tr>
<td>Course over ground (COG)</td>
<td>Automatically updated from the position sensor connected to AIS.</td>
</tr>
<tr>
<td></td>
<td>This information might not be available</td>
</tr>
<tr>
<td>Speed over ground (SOG)</td>
<td>Automatically updated from the position sensor connected to AIS.</td>
</tr>
<tr>
<td></td>
<td>This information might not be available</td>
</tr>
<tr>
<td>Heading</td>
<td>Automatically updated from the ship's heading sensor connected</td>
</tr>
<tr>
<td></td>
<td>to AIS</td>
</tr>
<tr>
<td>Navigational status</td>
<td>Navigational status information has to be manually entered by the</td>
</tr>
<tr>
<td></td>
<td>OOW and changed as necessary, for example:</td>
</tr>
<tr>
<td></td>
<td>- underway by engines</td>
</tr>
<tr>
<td></td>
<td>- at anchor</td>
</tr>
<tr>
<td></td>
<td>- not under command (NUC)</td>
</tr>
<tr>
<td></td>
<td>- restricted in ability to manoeuvre (RIATM)</td>
</tr>
<tr>
<td></td>
<td>- moored</td>
</tr>
<tr>
<td></td>
<td>- constrained by draught</td>
</tr>
<tr>
<td></td>
<td>- aground</td>
</tr>
<tr>
<td></td>
<td>- engaged in fishing</td>
</tr>
<tr>
<td></td>
<td>- underway by sail</td>
</tr>
<tr>
<td></td>
<td>In practice, since all these relate to the COLREGs, any change</td>
</tr>
<tr>
<td></td>
<td>that is needed could be undertaken at the same time that the lights</td>
</tr>
<tr>
<td></td>
<td>or shapes were changed</td>
</tr>
<tr>
<td>Rate of turn (ROT)</td>
<td>Automatically updated from the ship's ROT sensor or derived from</td>
</tr>
<tr>
<td></td>
<td>the gyro.</td>
</tr>
<tr>
<td></td>
<td>This information might not be available</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Voyage-related</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship's draught</td>
<td>To be manually entered at the start of the voyage using the</td>
</tr>
<tr>
<td></td>
<td>maximum draft for the voyage and amended as required (e.g. –</td>
</tr>
<tr>
<td></td>
<td>result of de-ballasting prior to port entry)</td>
</tr>
<tr>
<td>Hazardous cargo (type)</td>
<td>To be manually entered at the start of the voyage confirming</td>
</tr>
<tr>
<td></td>
<td>whether or not hazardous cargo is being carried, namely:</td>
</tr>
<tr>
<td></td>
<td>- DG (Dangerous goods)</td>
</tr>
<tr>
<td></td>
<td>- HS (Harmful substances)</td>
</tr>
<tr>
<td></td>
<td>- MP (Marine pollutants)</td>
</tr>
<tr>
<td></td>
<td>Indications of quantities are not required</td>
</tr>
<tr>
<td>Destination and ETA</td>
<td>To be manually entered at the start of the voyage and kept up to</td>
</tr>
<tr>
<td></td>
<td>date as necessary</td>
</tr>
<tr>
<td>Route plan (waypoints)</td>
<td>To be manually entered at the start of the voyage, at the discretion</td>
</tr>
<tr>
<td></td>
<td>of the master, and updated when required</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety-related</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Short safety-related messages</td>
<td>Free format short text messages would be manually entered,</td>
</tr>
<tr>
<td></td>
<td>addressed either a specific addressee or broadcast to all ships</td>
</tr>
<tr>
<td></td>
<td>and shore stations</td>
</tr>
</tbody>
</table>

**Table 1 – Data sent by ship**

*Due to the amendment of MARPOL categorization of hazardous cargo by resolution MEPC.118(52), cargo type may be categorized as A, B, C or D, rather than X, Y, Z or OS on older AIS equipment, as described in SN.1/Circ.227 and SN.1/Circ.227/Corr.1.*
The table below indicates the equivalence of the old and new category indications:

<table>
<thead>
<tr>
<th>Current MARPOL category</th>
<th>Equivalent category on older AIS units</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>A</td>
</tr>
<tr>
<td>Y</td>
<td>B</td>
</tr>
<tr>
<td>Z</td>
<td>C</td>
</tr>
<tr>
<td>OS</td>
<td>D</td>
</tr>
</tbody>
</table>

The data is autonomously sent at different update rates:

- dynamic information: dependent on speed and course alteration (see tables 2 and 3);
- static and voyage-related data: every 6 minutes or on request (AIS responds automatically without user action); and
- safety-related text message: as required.

<table>
<thead>
<tr>
<th>Type of ship</th>
<th>General reporting interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ship at anchor or moored and not moving faster than 3 knots</td>
<td>3 min</td>
</tr>
<tr>
<td>Ship at anchor or moored and moving faster than 3 knots</td>
<td>10 s</td>
</tr>
<tr>
<td>Ship 0-14 knots</td>
<td>10 s</td>
</tr>
<tr>
<td>Ship 0-14 knots and changing course</td>
<td>3 1/3 s</td>
</tr>
<tr>
<td>Ship 14-23 knots</td>
<td>6 s</td>
</tr>
<tr>
<td>Ship 14-23 knots and changing course</td>
<td>2 s</td>
</tr>
<tr>
<td>Ship &gt;23 knots</td>
<td>2 s</td>
</tr>
<tr>
<td>Ship &gt;23 knots and changing course</td>
<td>2 s</td>
</tr>
</tbody>
</table>

**Table 2 – Class A shipborne equipment reporting intervals**

<table>
<thead>
<tr>
<th>Crafts not subject to SOLAS</th>
<th>Nominal reporting interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class B &quot;SO&quot; shipborne equipment not moving faster than 2 knots</td>
<td>3 min</td>
</tr>
<tr>
<td>Class B &quot;SO&quot; shipborne equipment moving 2-14 knots</td>
<td>30 s</td>
</tr>
<tr>
<td>Class B &quot;SO&quot; shipborne equipment moving 14-23 knots</td>
<td>15 s</td>
</tr>
<tr>
<td>Class B &quot;SO&quot; shipborne equipment moving &gt; 23 knots</td>
<td>5 s</td>
</tr>
<tr>
<td>Class B &quot;CS&quot; shipborne equipment not moving faster than 2 knots</td>
<td>3 min</td>
</tr>
<tr>
<td>Class B &quot;CS&quot; shipborne equipment moving faster than 2 knots</td>
<td>30 s</td>
</tr>
</tbody>
</table>

**Table 3 – Class B shipborne equipment reporting intervals**
Short safety-related messages

15  Short safety-related messages are fixed or free format text messages addressed either to a specified destination (MMSI) or all ships in the area. Their content should be relevant to the safety of navigation, e.g. an iceberg sighted or a buoy not on station. Messages should be kept as short as possible. The system allows up to 158 characters per message but the shorter the message the more easily it will find free space for transmission. At present these messages are not further regulated, to keep all possibilities open.

16  Operator acknowledgement may be requested by a text message. The operator should be aware that there are special safety-related messages and special user identities form devices such as the AIS-SART. Details are given in SN.1/Circ.322, as amended. There is no need for acknowledgement by a text message.

17  Short safety-related messages are only an additional means of broadcasting maritime safety information. Whilst their importance should not be underestimated, use of such messages does not remove any of the requirements of the GMDSS.

18  The operator should ensure that he displays and considers incoming safety-related messages and should send safety-related messages as required.

19  According to SOLAS regulation V/31 (Danger messages)

"The master of every ship which meets with dangerous ice, a dangerous derelict, or any other direct danger to navigation, or ...is bound to communicate the information by all the means at his disposal to ships at his vicinity, and also to the competent authorities..."

20  Normally this is done via VHF voice communication, but "by all the means" now implies the additional use of the AIS short messages application, which has the advantage of reducing difficulties in understanding, especially when noting down the correct position.

Confidentiality

21  When entering any data manually, consideration should be given to the confidentiality of this information, especially when international agreements, rules or standards provide for the protection of navigational information.

OPERATION OF AIS ON BOARD

Operation of the Transceiver Unit

Activation

22  AIS should always be in operation when ships are underway or at anchor. If the master believes that the continual operation of AIS might compromise the safety or security of his/her ship or where security incidents are imminent, the AIS may be switched off. Unless it would further compromise the safety or security, if the ship is operating in a mandatory ship reporting system, the master should report this action and the reason for doing so to the competent authority. Actions of this nature should always be recorded in the ship's logbook together with the reason for doing so. The master should however restart the AIS as soon as the source of danger has disappeared. If the AIS is shut down, static data and voyage-related information remains stored. Restart is done by switching on the power to the AIS unit. Ship's own data will be transmitted after a two-minute initialization period. In ports AIS operation should be in accordance with port requirements.
Manual input of data

23 The OOW should manually input the following data at the start of the voyage and whenever changes occur, using an input device such as a keyboard:
   - ship's draught;
   - hazardous cargo;
   - departure, destination and ETA;
   - route plan (way points);
   - the correct navigational status; and
   - short safety-related text messages.

It is recommended to use the United Nations Code for Trade and Transport Locations (UN/LOCODE) for the entry of the port of destination. In addition, it is recommended that the existing destination field be used for entering both the port of departure and the next port of call (space for 20 characters of 6 bit ASCII is available) using the UN/LOCODE.¹

Check of information

24 To ensure that own ship's static information is correct and up-to-date, the OOW should check the data whenever there is a reason for it. As a minimum, this should be done once per voyage or once per month, whichever is shorter. The data may be changed only on the authority of the master.

25 The OOW should also periodically check the following dynamic information:
   - positions given according to WGS 84;
   - speed over ground; and
   - sensor information.

26 After activation, an automatic built-in integrity test (BIIT) is performed. In the case of any AIS malfunction an alarm is provided and the unit should stop transmitting.

27 The quality or accuracy of the ship sensor data input into AIS would not however be checked by the BIIT circuitry before being broadcast to other ships and shore stations. The ship should therefore carry out regular routine checks during a voyage to validate the accuracy of the information being transmitted. The frequency of those checks would need to be increased in coastal waters.

DISPLAY OF AIS DATA

28 The AIS provides data that can be presented on the minimum display or on any suitable display device, as described in annex 1.

¹ SN/Circ.244.
Minimum display

29 The minimum mandated display provides not less than three lines of data consisting of bearing, range and name of a selected ship. Other data of the ship can be displayed by horizontal scrolling of data, but scrolling of bearing and range is not possible. Vertical scrolling will show all the other ships known to the AIS.

Graphical display

30 Where AIS information is used with a graphical display, the following target types may be displayed:

Sleeping target A sleeping target indicates only the presence of a vessel equipped with AIS in a certain location. No additional information is presented until activated, thus avoiding information overload.

Activated target If the user wants to know more about a vessel's motion, the target (sleeping) may be activated so that the display shows immediately:

- a vector (speed and course over ground);
- the heading; and
- ROT indication (if available) to display actually initiated course changes.

Selected target If the user wants detailed information on a target (activated or sleeping), it may be selected. Then the data received, as well as the calculated CPA and TCPA values, will be shown in an alpha-numeric window.

The special navigation status will also be indicated in the alpha numeric data field and not together with the target directly.

Dangerous target If an AIS target (activated or not) is calculated to pass preset CPA and TCPA limits, it will be classified and displayed as a dangerous target and an alarm will be given.

Lost target If a signal of any AIS target at a distance of less than a preset value is not received, a lost target symbol will appear at the latest position and an alarm will be given.

Other targets Other targets such as AIS-SART, AIS-AToN, may be displayed with special symbols (see SN.1/Circ.243/Rev.1 on Guidelines for the presentation of navigational-related symbols, terms and abbreviations).

Symbols

31 The user should be familiar with the symbology used in the graphical display provided.
**INHERENT LIMITATIONS OF AIS**

32 The OOW should always be aware that other ships, in particular leisure craft, fishing boats and warships, and some coastal shore stations including VTS centres, might not be fitted with AIS.

33 The OOW should always be aware that other ships fitted with AIS as a mandatory carriage requirement might switch off AIS under certain circumstances by professional judgement of the master.

34 In other words, the information given by the AIS may not be a complete picture of the situation around the ship.

35 The users must be aware that transmission of erroneous information implies a risk to other ships as well as their own. The users remain responsible for all information entered into the system and the information added by the sensors.

36 The accuracy of AIS information received is only as good as the accuracy of the AIS information transmitted.

37 The OOW should be aware that poorly configured or calibrated ship sensors (position, speed and heading sensors) might lead to incorrect information being transmitted. Incorrect information about one ship displayed on the bridge of another could be dangerously confusing.

38 If no sensor is installed or if the sensor (e.g. the gyro) fails to provide data, the AIS automatically transmits the "not available" data value. However, the built-in integrity check cannot validate the contents of the data processed by the AIS.

39 It would not be prudent for the OOW to assume that the information received from other ships is of a comparable quality and accuracy to that which might be available on its own ship.

**USE OF AIS IN COLLISION AVOIDANCE SITUATIONS**

40 The potential of AIS as an assistance for anti-collision device is recognized and AIS may be recommended as such a device in due time.

41 Nevertheless, AIS information may merely be used to assist in collision avoidance decision-making. When using the AIS in the ship-to-ship mode for anti-collision purposes, the following cautionary points should be borne in mind:

.1 AIS is an additional source of navigational information. It does not replace, but supports, navigational systems such as radar target-tracking and VTS; and

.2 the use of AIS does not negate the responsibility of the OOW to comply at all times with the Collision Regulations, particularly rule 7 when determining whether risk of collisions exists.

42 The user should not rely on AIS as the sole information system, but should make use of all safety-relevant information available.

43 The use of AIS on board ship is not intended to have any special impact on the composition of the navigational watch, which should continue to be determined in accordance with the STCW Convention.
44 Once a ship has been detected, AIS can assist in tracking it as a target. By monitoring the information broadcast by that target, its actions can also be monitored. Many of the problems common to tracking targets by radar, namely clutter, target swap as ships pass close by and target loss following a fast manoeuvre, do not affect AIS. AIS can also assist in the identification of targets, by name or call sign and by ship type and navigational status.

ADDITIONAL AND POSSIBLE FUTURE APPLICATIONS

AIS IN VTS OPERATIONS

Pseudo Targets broadcast by VTS

45 VTS centres may send information about vessels which are not carrying AIS and which are tracked only by VTS radar via the AIS to vessels equipped with AIS. Any VTS/generated/synthetic target broadcast by VTS should be clearly identified as such. Particular care should always be taken when using information which has been relayed by a third party. Accuracy of these targets may not be as complete as actual directly-received targets, and the information content may not be as extensive.

Text messages

46 VTS centres may also send short messages either to one ship, all ships, or ships within a certain range or in a special area, e.g.:

- (local) navigational warnings;
- traffic management information; and
- port management information.

47 A VTS operator may request, by a text message, an acknowledgement from the ship’s operator.

Note: The VTS should continue to communicate via voice VHF. The importance of verbal communication should not be underestimated. This is important to enable the VTS operator to:

- assess vessels’ communicative ability; and
- establish a direct communication link which would be needed in critical situations.

(D)GNSS corrections

48 (D)GNSS corrections may be sent by VTS centres via AIS.

MANDATORY SHIP REPORTING SYSTEMS

49 AIS is expected to play a major role in ship reporting systems. The information required by coastal authorities in such systems is typically included in the static voyage-related and dynamic data automatically provided by the AIS system. The use of the AIS long-range feature, where information is exchanged via communications satellite, may be implemented to satisfy the requirements of some ship reporting systems.
AIS in SAR operations

50 AIS may be used in search and rescue operations. By receiving messages from AIS-SART, operators get more accurate information, especially on the position of survival craft. In combined aerial and surface searches AIS may allow the direct presentation of the position on other displays such as radar or ECS/ECDIS, which facilitates the task of SAR craft. For ships in distress without AIS, the On Scene Coordinator (OSC) could create an AIS target.

AIDS TO NAVIGATION

51 AIS, when fitted to selected fixed and floating aids to navigation can provide information to the mariner such as:

- position;
- status;
- tidal and current data; and
- weather and visibility conditions.

AIS in an overall information system

52 AIS will play a role in an overall international maritime information system, supporting voyage planning and monitoring. This will help Administrations to monitor all the vessels in their areas of concern and to track dangerous cargo.
REFERENCE DOCUMENTS

- SOLAS Convention, chapter V
- Recommendation on performance standards for a universal shipborne Automatic Identification System (AIS), (MSC.74(69), annex 3)
- Performance Standards for survival craft AIS search and rescue transmitters (AIS-SART) for use in search and rescue operations (resolution MSC.246(83))
- Guidance on the use of the UN/LOCODE in the destination field in AIS messages (SN/Circ.244)
- ITU Radio Regulations, appendix 18, table of transmitting frequencies in the VHF maritime mobile band
- Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile frequency band (Recommendation ITU-R M.1371-5)
- IEC Standard 61993 Part 2: Class A shipborne equipment of the Universal Shipborne Automatic Identification System (AIS) Operational and Performance Requirements, Methods of Testing and required Test Results
APPENDIX 1

DESCRIPTION OF AIS

COMPONENTS

1. In general, an onboard AIS (see figure 1) consists of:
   - antennas;
   - one VHF transmitter;
   - two multi-channel VHF receivers;
   - one channel 70 VHF receiver for channel management;
   - a central processing unit (CPU);
   - an electronic position-fixing system, Global Navigation Satellite System (GNSS) receiver for timing purposes and position redundancy;
   - interfaces to heading and speed devices and to other shipborne sensors;
   - interfaces to radar/Automatic Radar Plotting Aids (ARPA), Electronic Chart System/Electronic Chart Display and Information System (ECS/ECDIS) and Integrated Navigation Systems (INS);
   - built-in integrity test (BIIT); and
   - minimum display and keyboard to input and retrieve data.

With the integral minimum display and keyboard unit, the AIS would be able to operate as a stand-alone system. A stand-alone graphical display or the integration of the AIS data display into other devices such as INS, ECS/ECDIS or a radar/ARPA display would significantly increase the effectiveness of AIS, when achievable.

2. All onboard sensors must comply with the relevant IMO standards concerning availability, accuracy, discrimination, integrity, update rates, failure alarms, interfacing and type-testing.

3. AIS provides:
   - a BIIT running continuously or at appropriate intervals;
   - monitoring of the availability of data;
   - an error detection mechanism of the transmitted data; and
   - an error check on the received data.
CONNECTIONS

The connection of AIS to external navigational display systems

4 The AIS can be connected either to an additional dedicated AIS display unit, possibly one with a large graphic display, or as an input to existing navigational system devices such as a radar display, ECS, ECDIS, or INS. Such system interconnection and data integration is recommended.

The connection of AIS to external portable navigational equipment

5 It is becoming common practice for pilots to possess their own portable navigational equipment, which they carry on board. Such devices can be connected to shipborne AIS equipment and display the targets they receive. Some Administrations require this connection to be provided at the bridge front.

Figure 1 – AIS Components
APPENDIX 2

TECHNICAL DESCRIPTION

1. AIS operates primarily on two dedicated VHF channels (AIS1 – 161,975 MHz and AIS2 – 162,025 MHz). Where these channels are not available regionally, the AIS is capable of automatically switching to alternate designated channels. However, this capability should only be considered for use in urgent, temporary situations, noting the possible adverse effects on AIS at sea.

2. The required ship reporting capacity according to the IMO performance standard amounts to a minimum of 2000 time slots per minute (see figure 1 below). The ITU Technical Standard for the Universal AIS provides 4500 time slots per minute. The broadcast mode is based on a principle called (S)TDMA (Self-organized Time Division Multiple Access) that allows the system to be overloaded by 400 to 500% and still provide nearly 100% throughput for ships closer than 8 to 10 NM to each other in a ship-to-ship mode. In the event of system overload, only targets far away will be subject to drop-out in order to give preference to targets close by that are a primary concern for ship-to-ship operation of AIS. In practice, the capacity of the system allows for a great number of ships to be accommodated at the same time.

Figure 1 – Principles of TDMA