Very Serious Marine Casualty

Death of Able Seaman on the M/V “Warnow Master” on 10/11/2017 in the port of Incheon, South Korea
Foreword

The sole objective of the safety investigation under the Marine Casualty and Incidents Investigation Law N. 94 (I)/2012, in investigating an casualty, is to determine its causes and circumstances, with the aim of improving the safety of life at sea and the avoidance of casualties in the future.

It is not the purpose to apportion blame or liability.

Under Section 17-(2) of the Law N. 94 (I)/2012 a person is required to provide witness to investigators truthfully. If the contents of this statement were subsequently submitted as evidence in court proceedings, then this would contradict the principle that a person cannot be required to give evidence against themselves.

Therefore, the Marine Casualties and Incidents Investigation Committee, makes this report available to interested parties, on the strict understanding that, it will not be used in any court proceedings anywhere in the world.

This investigation was not carried out as a joint investigation.
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<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/B</td>
<td>Able Seaman</td>
</tr>
<tr>
<td>BAC</td>
<td>Blood Alcohol Content</td>
</tr>
<tr>
<td>C/E</td>
<td>Chief Engineer</td>
</tr>
<tr>
<td>C/O</td>
<td>Chief Officer</td>
</tr>
<tr>
<td>CoC</td>
<td>Certificate of Competency</td>
</tr>
<tr>
<td>GA</td>
<td>General Alarm</td>
</tr>
<tr>
<td>CPR</td>
<td>Cardio-Pulmonary-Resuscitation</td>
</tr>
<tr>
<td>DPA</td>
<td>Designated Person Ashore</td>
</tr>
<tr>
<td>HSSE</td>
<td>Health, Safety, Security and Environment</td>
</tr>
<tr>
<td>ISM Code</td>
<td>International Management Code for the Safe Operation of Ships</td>
</tr>
<tr>
<td>Knots</td>
<td>Speed in nautical miles per hour</td>
</tr>
<tr>
<td>Lat.</td>
<td>Latitude</td>
</tr>
<tr>
<td>Long.</td>
<td>Longitude</td>
</tr>
<tr>
<td>LT</td>
<td>Local Time</td>
</tr>
<tr>
<td>m</td>
<td>Meter</td>
</tr>
<tr>
<td>MC</td>
<td>Management Company</td>
</tr>
<tr>
<td>MT</td>
<td>Metric Ton</td>
</tr>
<tr>
<td>NM</td>
<td>Nautical Mile</td>
</tr>
<tr>
<td>OS</td>
<td>Ordinary Seaman</td>
</tr>
<tr>
<td>PSN</td>
<td>Position</td>
</tr>
<tr>
<td>RCC</td>
<td>Rescue Coordination Centre</td>
</tr>
<tr>
<td>RPM</td>
<td>Revolutions per Minute</td>
</tr>
<tr>
<td>SAR</td>
<td>Search And Rescue</td>
</tr>
<tr>
<td>2/O</td>
<td>Second Officer</td>
</tr>
<tr>
<td>SMC</td>
<td>ISM Safety Management Certificate</td>
</tr>
<tr>
<td>SMM</td>
<td>Safety Management Manual</td>
</tr>
<tr>
<td>SMS</td>
<td>Safety Management System</td>
</tr>
<tr>
<td>SOLAS</td>
<td>Safety of Life At Sea Convention</td>
</tr>
<tr>
<td>STCW95</td>
<td>International Convention on Standards of Training, Certification and Watch keeping for Seafarers 1978, as amended</td>
</tr>
<tr>
<td>S-VDR</td>
<td>Simplified -Voyage Data Recorder</td>
</tr>
<tr>
<td>VTS</td>
<td>Vessel Traffic Services</td>
</tr>
<tr>
<td>UTC</td>
<td>Universal Time Coordinated</td>
</tr>
<tr>
<td>VHF</td>
<td>Very High Frequency Radio</td>
</tr>
<tr>
<td>ZT</td>
<td>Zone Time</td>
</tr>
</tbody>
</table>
1. Summary

In conducting the investigation, the Marine Accident Investigation Committee (MAIC), dispatched an Investigator who visited the vessel on 30/11/2017 at the port of Incheon, South Korea. He reviewed the events surrounding the casualty, crew statements and other documents provided by the HSE Manager, DPA and CSO of Marlow Navigation Co. Ltd. and the Master of M/V “Warnow Master”, and performed analyses to determine the causal factors that contributed to the casualty, including any management system deficiencies.

Casualty Description

The “WARNOW MASTER” is a 2009-built container vessel with a capacity of 1496 TEU. She was on time charter to a major Taiwanese containership company performing a liner service between South Korea, China, Taiwan and Philippines.

On 10th November 2017 01:25 LT the vessel had just completed cargo operations at Incheon, South Korea and was in the process of heaving up the mooring lines and depart for next destination.

The ship’s crew at the aft mooring station had just disengaged one mooring rope from a deck twin bollard and were carrying it by hand in order to tie it to the port winch. The rope’s end onboard the ship (ship end) was stored inside a steel storage basket welded on the deck. The other end (shore end) of this mooring rope had been released by the shore mooring men, from the shore bitt into the sea. Suddenly, the rotating propeller caught the mooring rope and violently dragged it via the Panama chock, vertically downwards. The ship end of the mooring rope was stuck inside the storage basket and consequently the dragging force broke the storage basket which hit and killed one AB at the aft mooring station. The AB died due to cardio pulmonary arrest and rupture (fracture) of his skull.

Conclusions

Direct Cause: Insufficient real-time assessment of the risk the mooring rope to be caught by the propeller, due to inadequate situational awareness and lack of proper attention.

Root Cause: Inadequate risk assessment of the unmooring operation.

Contributing Cause(s): No safety briefing and no tool box talk carried out before unmooring. Inappropriate use of the Personal Protective Equipment.

Recommendations

1. The Manager to use qualified personnel for the vessel’s mooring / unmooring operations. Documented proof to be provided within 3 months.

2. The Manager to reconsider the Risk Assessment form “D-02a Mooring operations” in order to address the risk of crew member’s injury under the “Mooring or heaving lines reeled on propeller or bow thruster” hazard. Documented proof to be provided within 3 months.
3. The Manager by way of a circular or other means to ensure that:

- Safety briefing and toolbox talk are conducted prior to mooring / unmooring operations
- Effective communication is done between the bridge and the forward and aft mooring stations
- Crew members are wearing PPE, especially during mooring and unmooring operations

Documented proof to be provided within 3 months.
2. Factual Information

Ship’s Name: Warnow Master

![Figure 1: The “Warnow Master”]

Ship Particulars

Name of ship: Warnow Master
IMO number: 9449833
Call sign: 5 B R D 2
MMSI number: 212 145 000
Flag State: Cyprus
Type of ship: Container vessel
Gross tonnage: 17068
Length overall: 180.37 m
Breadth overall: 25.26 m
Classification society: DNV - GL
Registered shipowner: Samaria Shipping Co. Ltd.
Ship’s company: Marlow Navigation Co. Ltd, Limassol, Cyprus
Year of build: 2009
Deadweight: 21200 t
Hull material: Steel
Hull construction: Double Hull
Propulsion type: 1 MAN B&W 8L 58/64 CD, 1 CPP MAN B&W, type VBS-1460, left turning
Type of bunkers: IFO - 380 cst
Number of crew on ship’s certificate: 11 crew members
Voyage Particulars

Port of departure: Incheon, South Korea
Next port of call: Qingdao, China
Type of voyage: International
Cargo information: 365 containers onboard at the time of the casualty
Manning: 17 crew members
Number of passengers: NIL

Marine Casualty or Incident Information

Type of marine casualty/incident: Very Serious Marine Casualty
Date/Time: 10/11/2017 @ 00:25 hours Ship’s Time (01:25 LT)
Location: Aft mooring station
Position (Latitude/Longitude): φ = 37°26.28’N / λ = 126°35.98’E (Port of Incheon, South Korea, at berth while unmooring)
Ship operation and Voyage segment: Ship completed cargo operations and was about to depart from the port of Incheon
Human Factors: Yes
Consequences: Death: 1

Shore authority involvement and emergency response

The casualty took place when the vessel was unmooring from berth while the crew was heaving up the mooring lines.

The involvement of the shore authorities and emergency response were immediate and as follows:

- An ambulance was called directly from the pilot as the Master was occupied with the urgency of the situation
- The Master called the company’s DPA and Alternate DPA to inform them of the casualty
- The paramedics tried to revive the A/B without success
- The local agent embarked the vessel to assist with the situation
- The police embarked the vessel to investigate the causes of the casualty
- Two representatives from the P&I Club embarked the vessel in order to ascertain the situation
- The Master and the 3rd Officer (who was in charge of the unmooring operation in the aft mooring station where the accident took place) were interrogated by the police onboard the vessel and in the police station and were eventually declared suspects for the casualty. Eventually, two weeks after the casualty they were released and sent back to their country of origin.
- The wiper who was also present at the time of the accident was interrogated and immediately released. He requested repatriation due to psychological trauma and was eventually sent back to his country of origin.
- The Death Certificate issued by the local hospital declares as causes of death cardiopulmonary arrest and rupture of the head. According to the local agent of the vessel, the official autopsy results from the National Institute of Scientific Investigation have not been confirmed yet.
3. Narrative

3.1 Sequence of Events

The “WARNOW MASTER” is a 2009-built container vessel with a capacity of 1496 TEU. She was on time charter to a major Taiwanese containership company performing a liner service between South Korea, China, Taiwan and the Philippines.

On 9th November 2017 11:00 LT the vessel arrived at the port of Incheon, South Korea and berthed alongside at 15:30 LT for cargo operations.

![Position of the vessel while at berth]

Figure 2: Port of Incheon container terminal. The WARNOW MASTER was approximately at the same position as indicated in the picture

The following table shows all the noteworthy events that took place before and after the casualty.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time (LT)</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/11</td>
<td>11:00</td>
<td>Vessel arrived at the port of Incheon anchorage</td>
</tr>
<tr>
<td>09/11</td>
<td>15:30</td>
<td>Vessel was berthed alongside at the container terminal and commenced cargo operations</td>
</tr>
<tr>
<td>09/11</td>
<td>22:18</td>
<td>The discharging operations were completed</td>
</tr>
</tbody>
</table>
The loading operations were completed and the pilot went onboard. The predeparture checklist was carried out.

The main engine was started [The main engine was started and reached 127 rpm at 01:06 according to the VDR data].

The main engine control was transferred to the bridge.

Cargo operations were completed; the stevedores disembarked.

The tug boats “SEVEN STAR” and “DAECHANG” were fastened on port bow and port quarter respectively.

The pitch was adjusted to 5% pitch ahead [according to the Master] or to 2% ahead [according to the VDR data] because the vessel is negative at pitch 0 and to give little forward propulsion to avoid the vessel going astern. The pilot advised to start heaving up the mooring ropes one by one at fwd and aft mooring stations. The Master gave order to start single up fwd and aft.

CASUALTY. The 3rd officer (at that time attending to the aft mooring station) urgently informed the bridge that the A/B had an accident and he requested assistance. Apparently one of the mooring ropes had been caught by the propeller. The force of the propeller caused the mooring rope’s ship end to break the steel basket in which it was stored and altogether hit the A/B who was attending the unmooring operations. The Master immediately informed the Chief Engineer to stop the main engine. The unmooring operation was thereby cancelled.

The 3rd officer reported that the A/B had no sign of pulse and breathing and was badly hurt. He tried to revive the A/B and noticed that his chest was soft and seemed that he had a broken rib cage. The Master immediately asked the pilot to call for an ambulance and inform the vessel’s local agents as soon as possible.

The main engine was fully stopped and reached 0 rpm.

The 2nd officer arrived at the aft mooring station and helped to revive the A/B.

The Master informed the company’s DPA and the Alternate DPA.

An ambulance arrived and paramedics tried to revive the A/B.

The paramedics stopped their efforts as the A/B had already passed.

The vessel re-moored at dock.

The local agent went onboard.

The local police went onboard.

The P&I representatives went onboard.

The body of the A/B was brought ashore.

The police and local agent disembarked.

Divers commenced work in order to disengage the caught mooring rope from the propeller.
<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/11</td>
<td>12:15</td>
<td>The operation was completed. The cut and damaged mooring rope was brought onboard</td>
</tr>
<tr>
<td>10/11</td>
<td>14:00</td>
<td>The vessel was shifted to a waiting berth</td>
</tr>
<tr>
<td>11/11</td>
<td></td>
<td>The Master, the 3\textsuperscript{rd} officer and another A/B (present at the aft mooring station) went to the police department for interrogation</td>
</tr>
<tr>
<td>11/11</td>
<td></td>
<td>The company arranged for new Master, 3\textsuperscript{rd} officer and wiper as they were informed by the police that the Master and the 3\textsuperscript{rd} officer would not be released as they were suspect for the death of the A/B. The wiper was released and immediately asked for repatriation due to psychological reasons.</td>
</tr>
<tr>
<td>13/11</td>
<td></td>
<td>The new crew members arrived onboard and the vessel sailed for next port.</td>
</tr>
</tbody>
</table>
4. Analysis

The purpose of the analysis is to determine the contributory causes and circumstances of the casualty as a basis for making recommendations to prevent similar accidents occurring in the future. The following analysis is based on crew statements provided by the Managers of the vessel Marlow Navigation Co. Ltd. and vessel’s documents retrieved by the MAIC investigator, when he conducted an investigation onboard the vessel on 30/11/2017 at the port of Incheon, South Korea.

4.1 Ship’s Class and Statutory Surveys

The following Class and Statutory surveys regarding the WARNOW MASTER were checked and confirmed.

<table>
<thead>
<tr>
<th>Certificate Description</th>
<th>Last survey</th>
<th>Valid until</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Surveys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main Class Renewal</td>
<td>07/07/2014</td>
<td>31/07/2019</td>
</tr>
<tr>
<td>Bottom Survey Complete</td>
<td>17/07/2017</td>
<td>31/07/2019</td>
</tr>
<tr>
<td>Propeller Shaft Arrangement</td>
<td>07/07/2014</td>
<td>07/07/2019</td>
</tr>
<tr>
<td>Shaft – Propeller Connection</td>
<td>01/08/2009</td>
<td>01/02/2025</td>
</tr>
<tr>
<td>Periodically UMS complete</td>
<td>07/07/2014</td>
<td>31/07/2019</td>
</tr>
<tr>
<td>Periodically UMS annual</td>
<td>17/07/2017</td>
<td>31/10/2018</td>
</tr>
<tr>
<td>Nautical Safety / Bridge Arrangement complete</td>
<td>07/07/2014</td>
<td>31/07/2019</td>
</tr>
<tr>
<td>Nautical Safety / Bridge Arrangement annual</td>
<td>17/07/2017</td>
<td>31/10/2018</td>
</tr>
<tr>
<td>Statutory Surveys</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load Line renewal</td>
<td>07/07/2014</td>
<td>31/07/2019</td>
</tr>
<tr>
<td>Safety Construction renewal</td>
<td>07/07/2014</td>
<td>31/07/2019</td>
</tr>
<tr>
<td>Safety Equipment renewal</td>
<td>07/07/2014</td>
<td>31/07/2019</td>
</tr>
<tr>
<td>Safety Radio renewal</td>
<td>07/07/2014</td>
<td>31/07/2019</td>
</tr>
<tr>
<td>Safety Management – Vessel renewal</td>
<td>17/10/2014</td>
<td>20/11/2019</td>
</tr>
<tr>
<td>Ship Security renewal</td>
<td>17/10/2014</td>
<td>20/11/2019</td>
</tr>
<tr>
<td>Maritime Labour Convention renewal</td>
<td>30/03/2013</td>
<td>29/03/2018</td>
</tr>
<tr>
<td>Oil Pollution Prevention renewal</td>
<td>07/07/2014</td>
<td>31/07/2019</td>
</tr>
<tr>
<td>Air Pollution Prevention renewal</td>
<td>07/07/2014</td>
<td>31/07/2019</td>
</tr>
</tbody>
</table>

Comments / Recommendations:

1. All certificates onboard the ship as well as the Class and Statutory surveys were found to be in order and valid. There were no conditions pending related to Class or Statutory items.

4.2 Certification

The Minimum Safe Manning Document (MSMD) was issued by the Cyprus Maritime Authority on 26/10/2017 permanently, requires 11 crew members to be onboard the vessel and is shown below.
In addition, the MSMD clearly states that “The grades / capacities and numbers of personnel listed in this document indicate the minimum number of persons necessary for the safety of navigation, the security, the safe operation of the ship and the protection of the environment. The engagement of additional personnel as may be considered necessary for cargo handling and control, maintenance and watchkeeping and as needed for compliance with the required rest periods, is the responsibility of the owner / manager and the master.”

It is noted that the MSMD requires for three deck lower crew (A-class) and one deck lower crew (B-class). The crew onboard the vessel at the date of the incident was 17 crew members. To cover the above requirement the Manager of the vessel decided to employ two A/Bs and one bosun for the first requirement and one O/S for the second requirement.

The Manager did not employ any additional deck crew members except for the minimum required. This resulted that during the unberthing operation when the casualty took place, the wiper was employed to assist with the unmooring of the vessel.

According to the Manager’s Safety Management System manual the job description of the wiper is the following:

1. Familiarize with the engine machinery and equipment
2. Carry out engine operational tasks
3. Carry out engine maintenance tasks
4. Assist with port / cargo / security / safety watches

The job description for the wiper does not include any deck operations and more importantly any mooring / unmooring operations.
The wiper was not onboard in order to receive a statement from him, but the following comments can made:

1. The mooring deck is a highly dangerous zone where only trained staff should be engaged in deck operations. The wiper’s job description does not include any deck operations.
2. The wiper is neither trained to handle the mooring ropes, nor qualified to use the mooring winch.

Comments / Recommendations:

1. The Manager to use qualified personnel for the vessel’s mooring / unmooring operations.

4.3 Snap – back zones and Personal Protective Equipment (PPE)

The characterization of snap-back zones has changed and from now on, owning to the design of mooring decks, the entire area should be considered a potential snap-back zone, and not just some specific areas of the mooring decks. All crew working on a mooring deck should be made aware of this with a clear visible signage. Of course, mooring decks are working areas and it is not suggested that they become complete exclusion zones, which would be an absurdity. However, it is recommended that on-board risk assessments are conducted to ensure potential snap-back zones are identified, taking into account the various mooring configurations that may be employed. Mooring plans should also illustrate the identified snap-back hazardous zones. Prior to each operation, the mooring teams should carry out a pre-mooring tool box talk to ensure all participating crew members are aware of the hazards of snap-back and probable areas of the mooring deck that are not safe when mooring lines are under load.

The above was examined onboard the vessel. The entrances of the mooring decks were clearly signed with the following warning:

![Figure 4: Warning signage of entering a snap back hazard zone on the aft mooring deck](image)

According to the report from “Korea Surveyors and Adjusters Co. Ltd.” who attended onboard the vessel at the day of the casualty, the deceased A/B was wearing a safety helmet which was found on
the deck having its belt fastened over the visor, i.e. the A/B did not tighten the belt under his chin at the time of the casualty.

According to the certificate of death issued by the Incheon Salang Hospital on the 10th November 2017, the A/B’s cause of death was cardiopulmonary arrest and rupture of head.

Comments / Recommendations:

1. It is unknown at the moment whether the rupture of the A/B’s head occurred due to the hit of the mooring rope storage basket or due to his following violent fall on top the deck / bollard. It is also uncertain whether he would have survived the hit, had he tightened the safety helmet on his head. The cause of death was not only due to head injuries but also due to a heart attack most probably caused by the magnitude of the hit which broke his ribs. It is recommended that the Manager issues a circular for all vessels under management in which the importance of wearing PPE is emphasized especially during mooring and unmooring operations.

4.4 Aft mooring arrangement

At the time of the casualty the vessel had completed cargo operations at the port of Incheon and was ready to depart from berth for next port [Qingdao, China]. The pilot was already onboard, two tugboats were fastened on the port side of the vessel and the main engine was running. The aft of the vessel was moored by using four stern lines and two spring lines. The mooring rope that was caught by the propeller was the 2nd additional stern line shown in the figure below.

The aft mooring arrangement of the vessel before any mooring ropes were disengaged was the following:

<table>
<thead>
<tr>
<th>Mooring rope</th>
<th>Position</th>
<th>Engagement to ship</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stern Line</td>
<td>Secured on the port winch, then via the port deck stand roller, through the port universal fairlead, to a shore bitt</td>
</tr>
<tr>
<td>2</td>
<td>1st additional stern line</td>
<td>Secured on the stbd twin bollard, then through the stbd universal fairlead, to a shore bitt</td>
</tr>
<tr>
<td>3</td>
<td>2nd additional stern line</td>
<td>Secured on the port twin bollard, then through the Panama chock, to a shore bitt</td>
</tr>
<tr>
<td>4</td>
<td>3rd additional stern line</td>
<td>Secured on the port twin bollard, then through the Panama chock, to a shore bitt</td>
</tr>
<tr>
<td>5</td>
<td>Spring line</td>
<td>Secured on the stbd winch, then through a universal fairlead to a shore bitt</td>
</tr>
<tr>
<td>6</td>
<td>Additional spring line</td>
<td>Secured on the stbd winch, then through a Panama chock to a shore bitt</td>
</tr>
</tbody>
</table>
Figure 5: The aft mooring arrangement

Figures 6 & 7: Mooring arrangement of the WARNOW MASTER as on 30/11/2017. Note that at that date there was one stern line less. The other lines had very similar arrangement as on the date of the casualty.

There were four crew members present at the aft mooring station of the vessel attending to the release and heaving up of the stern mooring lines.

They were the following:
1. The 3\textsuperscript{rd} officer – overall responsible for the unmooring operation at the aft mooring station. He was located at the aft manoeuvring station on the starboard side of the vessel overlooking the mooring lines and communicating with the bridge and the fwd mooring station via VHF.

2. 1\textsuperscript{st} A/B – located close to the port aft winch of the vessel attending to the heaving up of the stern mooring lines.

3. 2\textsuperscript{nd} A/B – located on the stbd side of the mooring station attending to the spring lines.

4. The wiper – located close to the port aft winch of the vessel attending to the heaving up of the stern mooring lines together with the 1\textsuperscript{st} A/B.

According to the statements by the crew members and the available VDR data, after the tug boats were securely fastened on the port side of the vessel, the Master gave order for bringing onboard one by one the mooring ropes and to use extra precaution. The crew members on the aft mooring station made the following actions:

1. The 1\textsuperscript{st} additional stern line was heaved up and secured by using the starboard winch.

2. The 3\textsuperscript{rd} additional stern line was heaved up and secured by using the port winch. It was stored on the storage part of the mooring drum.

3. The 1\textsuperscript{st} A/B and the wiper had just finished securing the 3\textsuperscript{rd} additional stern line on the port winch drum. Then, they slackened the 2\textsuperscript{nd} additional stern line, so as the shore lines-men, be able to disengage it from the shore bitt. Then, they disengaged it (the 2nd additional stern line) from the port twin bollard and carried by hand the body of the rope in order to engage it with the warping head of the port winch. (The “ship end” of the mooring rope was passing through the Panama chock located in the centreline of the stern, then via the port twin bollard to a steel storage basket located just forward of the port winch. The “ship end” of the mooring rope was attached to the storage basket via a small cord. This better illustrated in the picture of below).

4. The shore lines-men after order from the 3\textsuperscript{rd} officer, disengaged the “shore end” of the 2nd additional stern line and thrown it into the sea.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure8}
\caption{The path of the 2\textsuperscript{nd} additional stern line}
\end{figure}
5. Suddenly the slacks of the rope, were caught by the rotating propeller. Then, the propeller dragged the rope, vertically towards the water, via the Panama chock. The 1st A/B who was holding the rope on his hands did not have the time to secure it on the warping end of the port winch. He attempted unsuccessfully to stop the rope with his foot. The rope was moving quickly towards the water when its “ship end” was blocked inside the storage basket that was already semi-stored. The strength of the propeller forced the stuck rope to break the storage basket from its welded foundations and pulled the basket towards the aft of the ship.

6. The 1st A/B was hit by the moving steel basket and was thrown on the deck next to the port twin bollard.

7. The mooring rope was finally released from inside the storage basket and was drawn into the sea by the propeller. The damaged and broken storage basket remained onboard the ship.

Figure 9: The port deck stand roller and the port winch

Figure 10: The broken storage basket with the damaged mooring rope
Figure 11: Another view of the casualty scene

Figure 12: View of the broken welded foundations of the storage basket

Figure 13: The storage basket with high indentations
Comments / Recommendations:

1. The mooring arrangement of the aft of the vessel was an adequate mooring arrangement taking into account the type of the vessel, the port characteristics and the weather conditions. The mooring arrangement of the fore part of the vessel was also examined and found to be in order.

4.5 Low tide

The port of Incheon is characterized by the high and low tide variations that occur during each day. At the date and time of the casualty there was a low tide at Incheon port with an HdG of about 2.8 meters. The characteristics chart is shown below.

![Tide Chart of Port of Incheon](image)

*Figure 14: The tide chart of port of Incheon*

According to the ship’s passage plan, at the date and time of the casualty the aft draft was 6.5 meters and the draft Forward was 6.05m. High tide in Incheon was at 20:57 LT with range 8.5m and Low tide was 03:08 LT the following morning with a range 1.5m. The vessel was departing during the ebb tide, which caused additional flow of water from aft towards the propeller. Therefore, ebb tide may have contributed to the dragging of the mooring line towards the propeller.

Incidentally, when the MAIC investigator visited the vessel, the vessel was at the same port and the same berth as when the casualty took place. In addition there was also a low tide at the port during the time that the MAIC investigator was onboard and the draft of the vessel was more or less similar to the draft of the vessel when the casualty took place.

Here below is a characteristic picture of the vessel (which was loading containers at that time) at the specific berth during low tide.
The “ship end” of the mooring rope was passing through the Panama chock located in the centreline of the stern, then via the port twin bollard to a steel storage basket located just forward of the port winch. The “ship end” of the mooring rope was attached to the storage basket via a small cord.

**Comments / Recommendations:**

1. The fact that the mooring rope was tied with a small cord to the storage basket did not play any particular role. It is evident from the photographs of the heavily distorted storage basket that the mooring rope was stuck inside the storage basket and when the force of the propeller dragged the rope, the top area of the storage basket was bent and the foundations of the storage basket were broken. Thereafter the whole body of the rope and the storage basket was pulled by the propeller and hit the A/B.

**4.6 Condition of the mooring ropes**

The list of the vessel’s mooring ropes / wires and cargo wires was examined onboard. The last updated list was issued on 07/11/2017.

The characteristics of the mooring ropes of the aft station were the following.

<table>
<thead>
<tr>
<th>Date of supply</th>
<th>Size (inches)</th>
<th>Condition (in %)</th>
<th>Length (m)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.06.2017</td>
<td>8&quot;, 64mm</td>
<td>100%</td>
<td>220</td>
<td>On PS Winch. NYLON ROPE</td>
</tr>
<tr>
<td>25.02.2017</td>
<td>8&quot;, 64mm</td>
<td>100%</td>
<td>220</td>
<td>On SS Winch. POLYESTER ROPE</td>
</tr>
<tr>
<td>N/A</td>
<td>8&quot;, 64mm</td>
<td>Fair, 70%</td>
<td>110</td>
<td>P/S used aft spring</td>
</tr>
<tr>
<td>N/A</td>
<td>8&quot;, 64mm</td>
<td>Fair, 70%</td>
<td>110</td>
<td>P/S used aft stern</td>
</tr>
<tr>
<td>N/A</td>
<td>8&quot;, 64mm</td>
<td>Fair, 70%</td>
<td>110</td>
<td>S/S used aft stem</td>
</tr>
<tr>
<td>N/A</td>
<td>8&quot;, 64mm</td>
<td>Fair, 65%</td>
<td>110</td>
<td>S/S used aft spring</td>
</tr>
</tbody>
</table>

**Figure 16: The characteristics of the mooring ropes of the aft mooring station**

The mooring rope that is highlighted is the one that was caught by the propeller. Its condition when the investigator saw the rope onboard was fair, but totally damaged due to the intervention by the divers.
in order to release it. The particular mooring rope was of the floating type. The certificates of all mooring ropes were examined and found to be in order.

**Comments / Recommendations:**

1. *The type / condition of the mooring rope that was caught by the propeller did not play any particular role in the casualty.*

### 4.7 Risk assessment

The risk assessment form which was filled in before the unmooring process at the day of the casualty describes the following risk which refers to exactly the casualty that took place:

- Hazard: Mooring or heaving lines reeled on propeller or bow thruster
- Consequence: Damages to property, damages to equipment
- Current control measures in place: MN 35-130, (This is Chapter 35 of the SMS manual: Ship Management – Port and Cargo Operations, Safe Mooring Operations”). Additionally: Proper communications between all parties, proper mooring planning and constant control from Master. Use only floating mooring lines.
- Likelihood of risk: 2
- Severity of harm may result from the Risk: 3
- Risk Level: 6 (MEDIUM)
- Further control measures required: NIL

**Comments / Recommendations:**

1. The risk assessment made for this potential hazard was inadequate. The consequences of this hazard address only property and equipment damages and not any possible harm to the crew members who attend the mooring operations.

2. *In addition, tidal current at the specific berthing location of the vessel, which increased the risk of the mooring rope being caught by the propeller, was not taken into account in the “Further control measures required” section.*

   *It is recommended that the Risk Assessment form “D-02a Mooring operations” addresses the risk of crew member’s injury under the “Mooring or heaving lines reeled on propeller or bow thruster” hazard.*

### 4.8 Fatigue

The record of work and rest hours was examined onboard the vessel. The records regarding the A/B show that all relevant MLC and STCW regulations were kept and hence fatigue was not considered a contributory factor to the casualty.

**Comments / Recommendations:**

1. *Fatigue was not considered as a factor to the casualty.*
4.9 The Environment

The weather conditions at the time of the casualty were as follows.

Air Temperature: 14º C
Sea Temp: 9º C
Sea Scale: 1
Wind Direction: E
Wind Force: 2
Visibility: Night time

Comments / Recommendations:

There is no evidence that physical environmental factors, such as weather, climate, etc., affected the unmooring operation. Nevertheless, tidal current may have been a contributing factor to the accident. Ebb tide during departure, may have contributed to the dragging of the mooring line towards the propeller.
5. Conclusions

Conclusion(s)

The following conclusions regarding the causes of the casualty can be derived:

1. The vessel’s aft mooring party, slackened the “ship end” of the rope, so as the shore mooring men would be able to disengage the “shore end” of the rope, from the shore bitt. As soon as adequate slacks were provided, the shore mooring men disengaged the “shore end” of the rope from the shore bitt and dropped it onto the sea surface.

The ship’s breadth equals to 25.0m, therefore the distance between the Panama chock and the stbd edge of the stern is 12.5m. From the photographs, the length of the rope from the Panama chock to the shore bitt, should have been about 20.0m. Added to this length, the slacks which were given in order the shore lines-men to be able to disengage the rope from the shore bitt. Considering that the vertical distance between the Panama chock and the level of the sea is 10m, more than 10m of rope were lying onto the sea surface and possibly coiling behind the stern.

The “ship end” of the rope was passing through the Panama chock (located in the centreline of the stern directly above the propeller) straight down to the propeller. The propeller, at the draft of 6.50m, was just underneath the sea level.

The controllable pitch propeller was turning with negative effect during departure, i.e. since main engine was started at 01:10 LT. Unmooring commenced at 01:22 LT. Setting at 01:24 LT CPP 5% Ahead (according to the Master) (VDR = 2%) in order to prevent vessel movement astern and flush lines away from vessel transom and propeller, was insufficient and late to prevent flushing of the rope towards the propeller.

Also, a Tug-Boat was fastened on the vessel’s aft quarter, therefore, there is a possibility that the mooring line was flushed toward ship’s propeller by this Tug operating off the stern.

Therefore, the following factors, in conjunction, contributed to the dragging of the mooring rope by the propeller:

(a) The negative pitch of the propeller
(b) The insufficient ahead pitch set to counter the negative pitch of the propeller
(c) The tug operating off the stern
(d) The ebb tide in the port of Incheon
(e) The excessive length of the mooring rope which was adequate (factually) to reach the propeller

2. The 3rd officer obeying Bridge instructions without checking propeller clearance and warning the Bridge. The hazard created by the above external factors, was not noticed and communicated by the 2nd Officer to the Bridge, due to insufficient real-time assessment of the risk the mooring rope to be caught by the propeller, due to lack of proper attention. (Direct Cause)

3. The fact that the mooring rope was tied with a small cord to the storage basket did not play any particular role. It is evident from the photographs of the heavily distorted storage basket that the mooring rope was stuck inside the storage basket and when the force of the propeller dragged the rope, the top area of the storage basket was bent and the foundations of the storage
basket were broken. Thereafter the whole body of the rope and the storage basket was pulled by the propeller and hit the A/B.

4. The risk assessment made for this potential hazard was inadequate. The consequences of this hazard address only property and equipment damages and not any possible harm to the crew members who attend the mooring operations. In addition, the specific berthing condition of the vessel under low tide with subsequent tidal current, which increased the risk of the mooring rope being caught by the propeller, was not taken into account in the “Further control measures required” section. Therefore, inadequate risk assessment for unmooring operation was a factor in the accident. (Root Cause)

5. There was no safety briefing and no tool box talk carried out. (Contributing factor)

6. It is unknown at the moment whether the rupture of the A/B’s head occurred due to the hit of the mooring rope storage basket or due to his following violent fall on top the deck / bollard. It is also uncertain whether he would have survived the hit, had he tightened the safety helmet on his head. The cause of death was not only due to head injuries but also due to a heart attack most probably caused by the magnitude of the hit which broke his ribs. It could be derived that the inappropriate use of the Personal Protective Equipment is a contributing cause of the casualty. (Contributing factor)

Conclusions / Causes of the accident

**Direct Cause:** Insufficient real-time assessment of the risk the mooring rope to be caught by the propeller, due to inadequate situational awareness and lack of proper attention.

**Root Cause:** Inadequate risk assessment of the unmooring operation.

**Contributing Cause(s):** No safety briefing and no tool box talk carried out before unmooring.

Inappropriate use of the Personal Protective Equipment.
6. Recommendations

1. The Manager to use qualified personnel for the vessel’s mooring / unmooring operations. Documented proof to be provided within 3 months.

2. The Manager to reconsider the Risk Assessment form “D-02a Mooring operations” in order to address the risk of crew member’s injury under the “Mooring or heaving lines reeled on propeller or bow thruster” hazard. Documented proof to be provided within 3 months.

3. The Manager by way of a circular or other means to ensure that:

   • Safety briefing and toolbox talk are conducted prior to mooring / unmooring operations
   • Effective communication is done between the bridge and the forward and aft mooring stations
   • Crew members are wearing PPE, especially during mooring and unmooring operations

Documented proof to be provided within 3 months.