ANNEX 1

LESSONS LEARNED FROM MARINE CASUALTIES

1 COLLISION

Very serious marine casualty: Two crew members drowned…..

What happened?

A container ship collided with two fishing vessels that were fishing in parallel, connected by wires, pulling one set of fishing gear. Both fishing vessels foundered causing the drowning of two crew members. The container ship sustained only superficially hull damage. The container ship collided with the paired fishing vessels while passing through multiple groups of other vessels engaged in fishing when it failed to take action to avoid collision.

Why did it happen?

- Traffic situation.
- Communication and information exchange between pilot and master on board the container ship was not as required in the sense of Bridge Resource Management.
- There was no communication between the vessels including sound or light signals.
- Non-adherence to the COLREGS (by all vessels?):
  - with respect to failure to display light, day and sound signals.
  - Failure to maintain a proper lookout.

What can we learn?

- Awareness of local dangers to navigation is to be increased by informing vessels and also pilots of fishing activities.
- Decisions in relation to avoiding close quarter situations or collision should be made well in advance and with time to spare.
- Bridge Resource Management should be implemented including the pilot; information should be shared and close cooperation is required.
- Fishing vessels fishing in cooperation should be made aware of the changed manoeuvring effects and difference in handling.
- Ensure that reliable means of communication is established between the cooperating vessels.
- Dangers of one person watch standing.

- Dangers of management pressure for navigational officers to conduct other duties on watch not associated with maintaining proper navigation.

- Dangers of fair weather and clear visibility resulting in lax navigational watch standing.

Who may benefit?

Ship managers, ships masters and navigational officers, pilots and pilot associations, fishing industry.

2 CAPSIZE, SINKING AND LOSS OF LIVES

Very serious marine casualty: Capsize and sinking of a tugboat and loss of lives while assisting a tanker

What happened?

Early in the morning, an 85,000 GT crude oil tanker encountered lightnings in thundery squally weather and strong wind gusts whilst loading cargo moored to a Single Buoy Mooring (SBM). A 500 GT tug vessel was in attendance, fastened at the stern of the tanker by a 31.5-metres long, 46 mm diameter steel wire towing pennant.

The Mooring Master 2 (MM2) ordered the tug to pull back the tanker from contacting the SBM. Shortly afterwards, the Terminal stopped loading and notice was given to the tanker to start its main engine.

Due to the combination of severe weather condition and the pulling by the tug, the bow chain connecting the tanker to the SBM parted and the tanker began drifting away from the SBM, risking damage to the cargo hoses.

To avoid damaging the cargo hoses, the tanker put its rudder hard to starboard, its engine at dead slow ahead and thruster to starboard. The engine was then progressively increased to slow and half ahead, with the rudder put hard to starboard.

Then the tug declared via VHF that it had an emergency on board. The tug was seen shipping seas on deck and rolling heavily when it took two successive large swells on her beam. The tug then capsized and quickly began to sink. The other mooring master (MM1) sent out Mayday, requesting immediate assistance. Another tug arrived shortly and immediately commenced search operation for any survivors.

Ten of the tug's twelve crew perished, one was lost, and one crew survived for three days in the overturned hull of the tug. There were no other injuries sustained anywhere and there was no pollution.

Why did it happen?

The bow chain connecting the tanker to the SBM parted due to the combined effects of the severe environmental condition and pull-back by the tug to prevent the tanker from contacting the SBM.

To mitigate the risk of damaging the cargo hoses and to keep the tanker in position and from drifting away from the SBM, the tanker had put its rudder hard to starboard, its bow thruster to starboard, and progressively increased its speed to slow and half ahead. The tug had its tow pennant fastened at the stern of the tanker. The tow pennant was directly shackled to the tug's tow line to the tug's towing winch. Neither gob wire nor towing pins – to prevent girting – were used. The tug wire had slipped on the gunwale to the deck house when the tug listed to starboard when it took two successive large waves on her beam before capsizing.

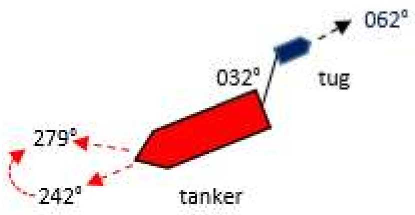

Figure 1. Tug-line was leading 032° (5 o'clock relative to the tanker's heading). Tug's centreline was parallel with tanker's centreline. Tug-wire slipped on gunwale to the deckhouse and the tug listed to starboard when the first wave hit her.

What can we learn?

- Be prepared for the environmental conditions in the area of operation. The incident occurred during the periods of changeover between wet and dry seasons where severe squalls with violent thunderstorms and winds of up to 60 knots are regularly experienced. Weather conditions before was stable with south-south east winds of 16 knots. The weather deteriorated rapidly with heavy rain, lightning, squalls up to 50 knots wind and unpredictable swell of 1.5-2.0 metres height were encountered. These conditions were consistent with known weather patterns and matched the METAREA forecast for the day in question.

- Importance of proper use of equipment.

  - One crew member, stationed aft of the tanker, reported that the towing pennant was connected directly to the tug's tow wire to the towing winch, neither gob wire nor towing pins were deployed. Another crew recalled that the wire to the tug was slipping on the gunwale to the deckhouse and the tug listed to starboard side when the first wave hit her. Had the tow pins (if fitted) and the gob wire been used, the tow wire would not have slipped on the gunwale.

  - The single length chafing chain parted. The investigation shows that the chain had a Safe Working Load (SWL) of between 230-458 tonnes. Recommendations for such chains is a proof load of 482 tonnes and a maximum breaking load of 612 tonnes.

Who may benefit?

Seafarers, shipowners and operators, flag administrators.

Appendix

1

Towing over-the-bow with azimuth stern drive tugs is much safer, more efficient and helps prevent tug girting. Pull-back tug selection should be carefully considered and an Anchor Handling Tug Supply vessel (AHTS) is not likely to be found suitable for the task. Failure to select suitable tugs may result in increased risk of an incident/accident between the terminal, the tug and the conventional tanker.

Tugs towing over the stern engaged in static towing that both towing pins and a gob wire assembly serve the purpose of controlling and reducing the movement of a towline or wire across the deck of a tug.
The control serves several purposes:

.1 tug safety, eliminating the risk of girting or capsizing;

.2 crew safety, enabling necessary work on aft deck during a tow or similar operations, if required; and

.3 steering and manoeuvring of tow or tug.

It is essential that all persons involved in controlling the tow operation are aware of the girting risks and causal factors, including a failure to maintain towing deck watertight integrity.

Girting occurs when a tug is towed broadside by a towline under tension and is unable to manoeuvre out of that situation.

Tug meets the IMO intact vessel stability criteria over the period of the intended operation and watertight integrity will be maintained at all times.

If a situation occurs which results in excessive tension on the towline, emergency quick release may be necessary. Winch operators should have a clear understanding of how to activate this equipment. Activation of this equipment will release tension in the towline and allow the tug to return upright and regain control.

To confirm the tow force being exerted by the tug, a transmitting load cell should be incorporated within the pull-back tug towline and the winch system.

Emergency disconnection of the towline may be appropriate in the following circumstances:

.1 the tug is unable to maintain station due to the rate of change of the tanker's heading;

.2 the tug's emergency release gear fails or is accidentally activated;

.3 the tug is manoeuvring incorrectly, e.g. towing incorrectly due to human error; or

.4 there is an emergency situation on the tug, e.g. girting, man overboard, etc.

Use of any emergency disconnection equipment should be thoroughly risk assessed and safety aspects and risks to all personnel and assets should be addressed.

Tug masters should participate in mooring simulation training exercises, together with mooring masters, in linked simulators to build confidence and understanding in the operation and between these key personnel.

Towing-over-the-bow is the preferred method, provided the tug is designed to do so and the crew are experienced in this method.

Tug masters and mooring masters should have a clear understanding of the conditions that could lead to girting of the tug and methods to identify and manage the risk.

All towing assembly components will degrade over time due to wear and tear. To ensure that the assembly is always fit for purpose, the tug operator should develop a towing assembly management plan which should include:

.1 identification of all critical components;

.2 training and competence for maintenance tasks such as splicing;

.3 schedules and instructions for inspections and maintenance;

.4 record-keeping including hours of use and load monitoring such as a towing log;

.5 establishment of clear retirement criteria for all critical components; and

.6 storage instructions for components in line with manufacturers' recommendations.

2

Chafe chains form a single chain of eight metres, or longer, that is composed of 76 millimetre stud links. The chafe chain should be long enough to prevent the synthetic hawser chafing on the fairleads of either the terminal or the offtake tanker. If chain-through support buoys are used (at the offtake tanker end of the mooring hawser) the chafe chain length may have to be increased to compensate for the buoy length.

Shackles used for connection of chafe chains to the hawser should be:

- bow shackles: Material BS EN10083-1:2006 605M 36 Grade T or equivalent SWL 42T PR load 59T BR Load 84T; and
- shackle pin: Material BS EN10083-1:2006 826M 40 Grade U or equivalent.

Terminal operators should select the appropriate chain, taking into account the designed SPM mooring configuration, required minimum breaking load (MBL) and the properties of the selected chain grade. Terminal operators should be aware that the MBL of a chain is based on a linear tensile force, so chafe chains in service may be subject to a lesser breaking load depending on the chain lead angle and the design method used to secure it.

The material of the chafe chains should be selected to match the required MBL of the mooring system. The rated strength should be at least equal to the 76 millimetre diameter IACS W22 Grade R3 or R4 (as a minimum), or equivalent stud link chain manufactured to the Society of Automotive Engineers' SAE 8630 (as amended), quenched and tempered to enhance its anti-abrasive wear characteristics. Certificates for the material forming the links should be obtained from recognized proving houses.

The weakest point in the mooring system should not be the offtake tanker mooring fittings.

Design of the mooring system weak link should ensure that the weakest point of a mooring system is never:

- the offtake tanker mooring fittings; or
- the terminal chain securing point.

The use of, and specification for, a weak link should be determined as a result of a risk assessment of the mooring system.

3 SINKING AND LOSS OF LIVES

Very serious marine casualty: Sinking of vessel resulting in loss of multiple lives

What happened?

A 30,000 GT roll-on/roll-off (ro-ro) cargo ship built in 1975 was en route from a port when she encountered a strengthening hurricane that had formed as a result of a tropical weather system. The Master diverted the vessel's passage, but the deviated passage took the vessel into the eye of the hurricane where she encountered heavy seas and winds.

Seawater started to enter the cargo hold through an open scuttle which caused the vessel to develop a prolonged starboard list. Due to the trim and list, the low lube oil sump tank levels could not maintain the propulsion causing the vessel to drift with its beam to the hurricane force winds and seas.

The vessel subsequently experienced progressive flooding and sank. Although a distress alert was sent 10 minutes prior to the sinking, the search and rescue efforts did not locate any survivors.

Why did it happen?

- The Master placed over-reliance on the weather data package, which was not up to date and was inaccurate, rather than heeding the advice of the navigating officers about the increasing intensity of the hurricane and proposed course changes. Inadequacies in the Bridge Resource Management techniques adopted on board affected the Master's situational awareness.

- The vessel suffered an initial list by an increasing wind on the vessel's beam generated by the hurricane. A scuttle which led to the cargo hold did not have any remote indications of it being open. This opening allowed unintended ingress of seawater into the cargo hold and affected the vessel's watertight integrity.

- The vessel's poorly maintained structures and ventilation dampers further compromised the watertight integrity of the vessel. The vessel's increased load line drafts due to her conversion had subsequently reduced her stability margin and thus increased her vulnerability in heavy weather.

- Lack of oversight of the stevedores and longshoremen resulted in the ro-ro cargo not being secured in accordance with the cargo securing manual, causing the cargo to break free and cause damage below the waterline.

- There was insufficient guidance for the engineers about the list-induced operational limitations of the engine as well as levels to be maintained in preparation for heavy weather. As a result, the vessel departed the port with a lower than recommended lube oil sump level which reduced the crew's ability to maintain lube oil suction for the main propulsion plant.

- The vessel's stability software did not identify the vessel's downflooding points which could have alerted the crew to close the ventilation openings. An approved damage control plan that would have assisted the crew in recognizing the severity of the vessel's condition and in responding to the emergency was not a requirement and thus not available.

- The company's oversight of the effectiveness of the safety management system relating to procedures for ensuring a safe passage, watertight integrity, heavy-weather preparations, emergency response during heavy-weather conditions and evaluating the performance of its officers was inadequate.
- The training for the crew did not cover damage control, stability instrument, advanced meteorology and advanced ship handling, Rapid Response Damage Assessment service, despite subscribing to such a service.
- The vessel's open lifeboats or the liferafts could not have provided adequate protection to the crew from the severe weather, even if they had been launched timely.

What can we learn?

The investigation report highlighted the importance of:

- Proper voyage planning taking into account all available sources, including seeking timely and accurate heavy weather advice.
- Effective implementation of Bridge Resource Management for ensuring the safety of the vessel and its crew.
- Proper and timely shore office support by identification of all associated risks including but not limited to training of crew for critical operations and emergency response.

Who may benefit?

Seafarers, shipowners and operators, flag administrators.

4 COLLISION, CAPSIZE AND LOSS OF LIVES

Very serious marine casualty: Collision between a container ship and a fishing vessel resulting in loss of lives

What happened?

A container ship was early in the morning entering a Vessel Traffic System (VTS) coverage area on her way to the arrival port. The Officer of the watch (OOW) reported its position and gave an Estimated Time of Arrival (ETA). At the time of arrival at the first reporting point, the Bridge of the container ship was manned by yet another officer and one duty able-bodied seaman (AB).

When coming closer to the port, another report was made to the VTS. The VTS then assigned a position for the container ship to anchor.

En route to that position, while at a speed of 15.3 knots, the container ship collided with a fishing vessel, causing the latter to capsize. The coxswain of the fishing vessel was trapped inside the wheelhouse where he subsequently drowned. The other fisherman fell into the sea and was lost.

Why did it happen?

- Non-compliance with the International Regulations for Preventing Collisions at Sea 1972 (COLREGs).

    - None of the vessels maintained a proper look-out. The target echo of the fishing vessel had appeared on the container ship's radar at a distance of more than 6 nautical miles, but the target was not plotted or checked in order to determine the risk of collision.

    - The fishing vessel, being the give-way vessel, did not comply with Rule 16 by not taking any action to keep well clear of the container ship.

    - The container ship, being the stand-on vessel in a crossing situation, did not comply with Rule 17 to keep her course and speed, or to take actions as will best aid to avoid collision.

- The container ship did not adhere to the requirements of its shipboard safety management manual relating to Navigating in High-Density Traffic Areas.

    - Before the collision, the container ship was proceeding at a speed of about 15 knots under the conn of a junior officer approaching a port area of high traffic density, without making its main engine ready for manoeuvring. The main engine was only put on stand-by and ready for manoeuvring after the collision, when the container ship was about 7 nautical miles to the entrance buoy.

- The container ship had no planned or executed proper voyage plan.

    - The voyage plan, including the relevant charts, had not been marked where the engine should be made ready for manoeuvring. In addition, the "master's orders for the passage" which required the duty officer to "keep sharp look-out, give wide berth to all passing vessels", and "to keep 1 nautical mile clear of all fishing vessels", was not followed.

- Weak and ineffective Bridge Resource Management and Teamwork on the Bridge of the container ship.

    - According to the Voyage Data Recorder (VDR), the screen display of the container ship's No. 1 radar was fixed on the 6 nautical miles range and displayed off-centre in the relative motion (RM) mode. Neither manual plotting of the fishing vessel, nor change of range or motion mode had been made during the period preceding the collision. No action was taken to check the bearing change of the fishing vessel by using the Electronic Bearing Line (EBL). The whistle was also not sounded to warn the fishing vessel.

What can we learn?

The investigation report highlighted the importance of:

- complying with COLREGs;

- proper planning and execution of the voyage plan;

- adherence to the Company's shipboard safety management manual with respect to navigating in areas of high traffic density; and

- the importance of effective Bridge resource management.

In order to ensure effective implementation of the shipboard Safety Management System (SMS), it is important to conduct internal audits and to provide additional training on Bridge resource management.

Who may benefit?

Seafarers, shipowners and operators, flag administrators.

5 PERSON OVERBOARD – PRESUMED DEAD

Very serious marine casualty: Fatality – crewmember washed overboard

What happened?

A laden tanker was en route in heavy weather with force 6-7 winds generated by a tropical storm. At first light on the morning of the accident, the chief mate on watch saw that the forward liferaft embarkation ladder had broken free of its lashings. When the master came to the bridge, the chief mate discussed securing the ladder. They decided to send a four-man team, including the chief mate, forward to secure the ladder and inspect the forecastle. A risk assessment for the task was conducted, in which all four team members participated.

After the master had reduced the ship's speed and altered course to decrease any waves coming on deck, the four-man team went forward. They identified other issues, including parted anchor wire lashings, so it was decided to address the store issues and inspect the forecastle store. While attending these tasks, one of them exited the store to check the starboard windlass while the other three remained inside. As the man was returning to the store, a large wave washed across the forecastle from port to starboard and washed him overboard. The master initiated a search in which two other ships and a rescue helicopter also joined. However, the man was not located and was presumed dead.

Why did it happen?

- The crewmember was in a very exposed location when the large wave washed across the forecastle.

- The risk assessment was inadequate for the weather conditions and resulted in the master and crew on deck developing a false sense of security.

- Identified precautions were not properly taken, including not making a sufficiently large course alteration and not using safety harnesses and lifelines.

- There was no contingency plan in case the inspection identified additional problems.

- Heavy weather precautions for encountering the tropical storm were inadequate.

What can we learn?

- It is critically important to ensure that a ship is properly secured for sea and that additional precautions are taken before encountering heavy weather.

- It is very hazardous to work on deck in heavy weather and should be avoided unless not doing so will expose the crew and ship to greater risk.

- If it is necessary to work on deck in heavy weather, a complete and realistic risk assessment must first be done followed by taking all necessary precautions.

- Appropriate alterations of course and/or speed are very important precautions before working on deck in heavy weather.

- Safety harnesses and lifelines must always be used in addition to other personal protective equipment identified for working on deck in heavy weather.

Who may benefit?

Seafarers, shipowners and operators.

6 FATAL INJURY

Very serious marine casualty: Fatality and injury of two shore workers during unmooring operations

What happened?

During unmooring operation in a shipyard, two shipyard workers were struck by the opened bight from a mooring line tail rope, which was used for the mooring of a liquefied natural gas tanker. One worker was fatally injured.

Why did it happen?

- The set of tail ropes used was recorded to be in good condition prior to being stored for 2 months. This could possibly have affected their condition.

- Shipyard personnel involved with mooring operations was not required to undergo a structured training programme as per competency standards for mooring/unmooring of ships.

- The inspection and appraisal criteria for mooring ropes did not specially include the inspection of the seizing twine, which like the main rope are subjected to similar operational and environmental conditions.

What can we learn?

- The shipyard reviewed its risk assessment and formulated new procedures (safe work procedures) for mooring/unmooring operations.

- When inspecting and appraising the condition of the tail rope, the condition of the seizing twine should be taken into account.

Who may benefit?

Ship managers, shipyards, shore workers, port management, government agency for work, health and safety.

7 OCCUPATIONAL ACCIDENT

Very serious marine casualty: Fatal fall overboard

What happened?

While preparing the pilot ladder the bosun sent his co-workers for more materials. On their return the bosun and the pilot ladder were missing. Having searched they raised the alarm. The bosun's body was recovered from the water sometime later and he died in hospital.

His safety harness was found at the scene. When recovered he was not wearing a lifejacket though he had been seen "wearing" one earlier.

Why did it happen?

- Bosun was not secured to the vessel when working close to the side.
- PPE (lifejacket and safety harness) was not worn.
- Lack of formal procedures in vessel's SMS for this operation – though it was established practice to wear a safety harness – on this occasion the bosun did not.
- Solo working at the time of the accident.

What can we learn?

- Just because an operation is routine does not mean it is of low risk (and thus not being considered in the SMS). It is important to regularly review the SMS to ensure that all operations are correctly considered and appropriate risk mitigation is put in place.
- It is the responsibility of all crew members to look after their own and co-workers' safety.
- In this instance correct wearing and used of provided PPE may have prevented the fatality.
- When solo working, the risks are heightened.

Who may benefit?

All shipowners and operators and vessel crews.

8 OCCUPATIONAL ACCIDENT

Very serious marine casualty: Fatality – struck by a length of drill pipe under tension

What happened?

A floor hand died when he was struck in the head by the bottom end of drill pipe as it was being moved from its storage location to the drill centre.

The vessel is equipped with an automated system for handling pipes. Drill pipes are stored vertically in the setback area and secured in a racking system, called a fingerboard, in the derrick which maintains the pipes vertically and prevents unintentional movement. The setback area is considered a no-entry zone while the pipe handling system is moving pipes.

While removing the 32nd section of pipe, a pipe latch failed to open properly, causing the pipe to bend under load of the handling equipment. As the floor hand stepped into the setback area, the latch released. The end of the pipe sprang out and the floor hand was fatally struck on the head.

It was his first day in the role of floor hand.

Why did it happen?

- Lack of formal training of the floor hand as to the risks involved.
- Poor visibility (situational awareness) of the pipe handling operator who couldn't see the pipe storage area or those working in it.
- Lack of adequate supervision of the floor hand in the first day on the job.
- The incident occurred the 32nd time the operation had been completed that day, leading to a desensitisation / lack of risk perception of the operation, leading to the casualty stepping into a no-go area.

What can we learn?

- Risks of operations need to be properly assessed and adequate mitigation measures put in place, the lack of accidents is not an indicator of safety.
- Staff new in roles need correct training and adequate supervision.
- Where operators of equipment do not have clear sight of the operating area, clear operational and communication protocol need to be stabled to make unseen areas safe before access.
- The risks of reparative jobs need to be regularly repeated to those involved.

Who may benefit?

Equipment operators, deck hands, deck officers.

9 Collision

Serious marine casualty: Collision of two cargo vessels in open sea

What happened?

A cargo vessel was navigating heading 240 degrees when the master noticed a target on radar approaching on the aft port quarter with a course of 270 degrees and a distance about 6 nautical miles. About half an hour later, the second officer noticed that the closest point of approach (CPA) had closed to 0.8 nm indicating that the vessel had changed course. The other vessel was turning to starboard toward own vessel which prevailed the second officer to immediately call the other vessel via VHF. As no answer was received, the second officer gave the command to alter the course to hard starboard but a collision between the two vessels could not be avoided.

Why did it happen?

- Both vessels' bridge teams did not maintain a proper or effective lookout to determine if a risk of collision exists.
- Safe speed was not kept related to the traffic situation.
- Not all available means to prevent risk of collision were used.

What can we learn?

- It is important to observe COLREG and good seamanship.
- All available navigational equipment to be adequately used in relation to the prevailing circumstances.
- The use of VHF communications at an early stage to avoid collision is important in the open sea in order to create awareness and a common understanding.
- AIS is to be used as a means to aid the lookout in combination with other means like ARPA.

Who may benefit?

Ship managers, ships masters and navigational officers.

10 CONTACT WITH QUAY

Serious marine casualty: Multi-purpose ship heavy contact with quay

What happened?

At a fair-weather afternoon, a pilot was navigating a multi-purpose ship to berth for cargo discharge. On bridge were also master and AB. A turn of the vessel within the inner basin was intended before getting alongside berth with port side. As two tugs arrived, one was asked to push at starboard mid-aft, the other to push at starboard stern to assist turning, but neither was asked to connect with a line because both pilot and master did not think it was necessary since the vessel had a bow thruster. The vessel arrived 110 metres away from quay at 2.6 knot, and the two tugs were pushing. A series of bow thruster, main engine and helm orders were given by pilot and were executed. The master reminded the pilot that the ship was moving too fast (2.4 knots), but 3 minutes later the vessel got heavy contact with the quay after the master tried to reduce speed by giving orders half astern and full astern.

Why did it happen?

- A detailed and appropriate pilotage plan was not prepared beforehand and the chosen position for turning in basin did not take the conditions at scene fully into consideration.
- The two tugs were not connected, so they could not be used to help reduce the vessel's speed.
- The master was not able to fully fulfil his role of assistance and supervision, as a result of his over trust in pilot and the absence of a detailed, fully communicated pilotage plan.
- Precautionary measures identified from risk assessment about the berthing operation were not fully implemented and no sufficient emergency actions were taken, i.e. let go both anchors.
- The company's shore base did not provide sufficient instruction and support to ship regarding the pilotage operation.

What can we learn?

- A detailed and appropriate pilotage plan, with all available ship and port information taken into consideration should be used.
- An agreement and shared understanding between the bridge team and pilot as to the pilotage plan and monitoring against the plan should be in place.
- The bridge team should actively promote and use the concept of bridge resource management, including the incorporation of pilots into the bridge teams, to manage voyages properly.

Who may benefit?

Seafarers, pilots, shipowners and operators.

11 CREWMEMBER WASHED OVERBOARD

Very serious marine casualty: Fatality falling overboard

What happened?

The 210 metre-long, 28,000 GT container ship was underway in heavy weather when it was noted that the port anchor was loose. Preparations were made to secure the anchor and the ship was turned to create a lee. Three crewmembers, including the chief officer, were on the forecastle attempting to secure the anchor when a large wave swamped the forecastle. The chief officer was washed overboard and an able seaman was seriously injured.

Emergency procedures were conducted and shore authorities notified. About 2.5 hours later the chief officer was sighted by ship's crew and then retrieved by a rescue helicopter. The two injured persons were evacuated ashore for further treatment. Unfortunately, the chief officer did not survive the injuries sustained during being washed overboard and from more than three hours in the water.

Why did it happen?

The task planning, including a risk assessment, did not adequately assess the hazards posed by the deck work in heavy weather. Furthermore, the planning did not ensure that the crewmembers involved used the personal protective equipment prescribed in the safety management system for work on deck during heavy weather. Lifejackets, safety harnesses and lifelines were not used.

Subsequently, the lee created by manoeuvring the ship, did not effectively shield the crewmembers on the forecastle from the heavy seas.

In addition to these factors, revised safety procedures resulting from a similar incident the previous year had not been effectively implemented.

What can we learn?

- All risks involved with any task being undertaken during heavy weather and/or on deck must be carefully and fully assessed and addressed. This includes the need to provide a lee for sufficient protection against the weather.

- Seafarer training should include regular emphasis on risk management, relevant techniques and emphasising the need to account for changing conditions and the importance of fully implementing risk controls. This should include strictly following guidance on the use of personal protective equipment.

- It is important that lessons learned from previous incidents result in full, effective and verified implementation of safety actions such as revised procedures.

Who may benefit?

Seafarers, management, shipowners.

12 BARGE CONTACT WITH VESSEL LEADS TO SUSPENDED LOAD BEING DROPPEDDROPPED

Very serious casualty: Fatality during engine maintenance

What happened?

A 120 metre-long, 7,000 GT geared general cargo ship was loading timber logs from barges at a remote anchorage. During the stay, the opportunity was taken to complete the scheduled overhaul of a main engine cylinder and piston. During reassembly, the piston and rod assembly was being lowered into the engine while suspended from the engine room crane. The first engineer entered the crankcase and climbed on top of the crosshead in an attempt to clear an obstruction.

At this time, a cargo barge made heavy contact with the ship causing severe vibrations throughout. The sudden movement caused the securing bolt of the piston lifting tool to fail and the piston and rod to fall. The first engineer was trapped and crushed between the piston rod foot and the crosshead assembly.

Why did it happen?

Task planning and identification of potential hazards did not fully consider the effects of vessel movement while conducting maintenance in the engine room. Furthermore, the lifting appliances and tools being used were not fully understood or adequately maintained. As a consequence, when contact between the cargo barge and the ship caused sudden movement, the lifting tool was stressed to failure. This allowed the piston and rod assembly to fall, trapping and fatally injuring the engineer.

The maintenance team were unfamiliar with the task and did not, therefore, effectively consider the risks associated with:

- the lifting tools, appliances and equipment being used and how to use them;
- personnel working in different positions on the engine and the difficulties in maintaining efficient and effective communication, supervision and direction between them; and
- the need to reassess risks and strategies during the work.

The remote location of the anchorage then limited access to timely medical assistance. This was inadequately considered when the decision was made to undertake this work. As a result, it was many hours before the severely injured person reached a hospital and professional medical assistance.

What can we learn?

- All vessel operations, including deck and cargo work, should be considered as part of risk assessments for any engine room maintenance tasks.
- The condition of all tools, equipment and fittings available for and used during maintenance tasks, especially for lifting, should be regularly checked and verified. Records of inspection and equipment histories should be maintained and referred to.
- Access to medical assistance should be considered when assessing and planning for any work done on board ship.
- Personnel should not, for any reason, pass or position themselves under a suspended load.

Who may benefit?

Seafarers, management, shipowners.

Intersession 2021

1 CAPSIZING

Very serious marine casualty: Vessel capsizing and foundering
What happened:

A live stock carrier of almost 4,000 GT, carrying almost 15,000 sheep, was outbound from a port, assisted by a pilot and two tugs. While pulled by the tugboats the vessel developed a list of 3-4 degrees. After the tugs let go, the list continued and the vessel lost stability and capsized. The crew abandoned the vessel before and was rescued.

Why did it happen:

- Before departure a large quantity of big bags (1 metre) was loaded on sun deck and bridge fore deck.
- The Stability booklet was not complied with and the stability was not assessed.

What can we learn:

- The vessel's stability has to be considered at all times.

Who may benefit:

Seafarers, ship owners.

2 MAN OVERBOARD

Very serious marine casualty: Man overboard resulting in loss of life

What happened:

Due to the possibility that stevedores were not available at arrival of the 30,000 GT fully cellular container vessel, the crew started to prepare by un-lashing the cargo while still at sea. A crew member, who did not wear a fall arrestor, nor a floatation device while unlashing the outboard container, could not balance himself after removing the long and heavy lashing rod and fell overboard into the sea.

Why did it happen:

- The risk assessment was not updated for lashing and unlashing tasks to be done on-site.
- Personal floatation device when performing unlashing task at outboard rows near ship side where there was a potential risk of drowning for a person falling in the water was not included in the vessels procedures.
- The investigation revealed that the review of the risk assessment for the unlashing task was ineffective as the safety control measures identified were not implemented. In addition, the Company's SMS did not require the wearing of floatation device when working near the ship side.

What can we learn:

- A review of the SMS procedures to clearly identify risks involved in different tasks and provide clear guidance what type of PPE should be worn accordingly could have prevented the accident.
- An effective risk assessment prior to a task is commencing would have identified the safety precautions necessary.

Who may benefit:

Seafarers, shipping companies.

3 LOSS OF CARGO

Very Serious marine casualty: Loss of 342 containers in storm

What happened:

A 190,000 GT fully cellular container vessel lost 342 containers during the passage of the TSS Terschelling-German Bight.

Why did it happen:

Owing to the severe weather, the vessel experienced heavy rolling and large accelerations on the cargo.

What can we learn:

Container loss

The investigation has revealed that during the passage through the TSS Terschelling – German Bight, the vessel experienced four different hydrodynamic phenomena, either individual or in combination, that played a role in the loss of containers.

- Extreme motions and accelerations;
- Contact or near contact with the sea bottom;
- Green water; and
- Slamming.

The main cause of the loss of containers was the high stability at which the ship was sailing in a beam sea scenario in shallow water conditions where it encountered combination of the four hydrodynamic phenomena. The encountered transversal accelerations were at the design limits, leading to failure of the container structure and/or the lashing equipment and subsequent container loss.

High stability

The actual GM of the vessel was typical for vessels of that size in operation. The high stability of large and wide Ultra Large Container Ships leads to shorter natural roll periods than smaller ships with lower stability. This brings the natural roll period closer to the wave periods that were present above the Wadden Islands during the accident, resulting in larger resonant roll motions in the beam seas. The shorter periods also result in higher accelerations. Large bilge keels are a way to reduce accelerations. Container ships like this one have insufficient roll damping in situations with large stability.

High stability is a safety risk that has not been recognised and formalised in the IMO Intact Stability Code and documents as the Stability Booklet. Current limits are only set for a minimum GM. The effects of high GM are underestimated.

Insight in accelerations

After the accident, the mechanical inclinometer indicated a deflection of about 30°. The crew interpreted this deflection as the actual heel angle of the ship and referenced in their statements following the accident to a 30° heel angle. The investigation determined that the maximum roll angle of the ship was in the order of 16°. The mechanical inclinometer is not a good instrument to determine the real roll angles a ship experienced, as the instrument is sensitive to accelerations. For the crew to act, it is essential to have insight in the actual forces and accelerations acting on the ship, containers and lashing system. The crew of the vessel had no indication on the bridge of occurring roll angles, forces and accelerations. The design of the mechanical inclinometers is generally insufficient for drawing conclusions as to the dynamic roll angle a ship experiences. *Equipment (such as electronic inclinometers or similar (inertia) systems that measure rolling angle and period, sensors on critical locations that measures accelerations), if fitted, can provide valuable information to the master and crew in such critical situations.*

Lashing and loading

The lashing equipment and container structures present on Ultra Large Container Ships are the similar on all other types of container ships. The Code of Safe Practice for Cargo Stowage and Securing (CSS code) cannot be used to calculate design accelerations for vessels like the this one. The design limits for lashing systems on an Ultra Large Container Ship are determined by complicated software calculations and are not transparent. Therefore, it cannot be checked whether the containers are loaded and secured in accordance with the regulations of the Cargo Securing Manual (CSM) and if the rules and guidelines regarding lashing have been complied with.

Routeing

According to all legal requirements the vessel was allowed to sail under the condition it sailed. The TSS Terschelling – German Bight is in the vicinity of the Wadden Sea, which is designated as a Particularly Sensitive Sea Area and a UNESCO World Heritage. The accident led to severe pollution of the area. The status of PSSA allows to implement additional protective measures for shipping under IMO. There are currently no specific requirements or restrictions for (large) container ships for the routes.

The pollution of the Wadden Sea by lost containers is an undesirable event. Interested coastal states need to propose to IMO additional associative protective measures for shipping to protect the PSSA.

Increase in scale beyond regulatory ranges

In general, the capacity of individual container ships doubled over the last 15 years. The growth resulted in container ships carrying more containers on deck. The length and operational GM of ultra large container vessels exceed the valid ranges of most international technical regulations and standards for calculation of accelerations.

The fact that the first losses of containers was not noticed by the crew is an undesirable event. If the crew had noticed the first loss, the necessary mitigating actions could have been taken and further container losses possibly avoided.

The size of the container ships continues to increase, as well as the share of the large ships in the fleet. This investigation revealed that the concept of the lashing of containers on deck of these large and wide ships needs to be reviewed and international technical and operational standards to be amended or developed where necessary.

Who may benefit:

All container vessels, seafarers, ship owners, coastal states, P&I, insurance companies, general public, the marine environment etc.

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