Marine Safety Investigation Unit

Transport Malta

SIMPLIFIED SAFETY INVESTIGATION REPORT

201512/049 REPORT NO.: 23/2016 December 2016

MV *Hagland Borg*

Serious injury involving a moveable bulkhead
At Karlshamn, Sweden
28 December 2015

Course of events

On 28 December 2015, at 1655, the Maltese registered general cargo *Hagland Borg* berthed at the port of Karlshamn in Sweden. The vessel had to discharge a cargo of timber, which was loaded from Helland, Norway and then load grain for Ventspils in Latvia.

By 2015 on 28 December, the discharge of timber had been completed and at 2200, the crew members were making the necessary arrangements to move the portable dividing bulkhead in the only cargo hold fitted on the vessel.

The bulkhead was fitted with a wheel arrangement on port side and another one on starboard side at the top edges (Figure 1). Two recesses were fitted to the portable bulkhead, which provided access to hydraulic jacks to be fitted (Figure 2).

The jacks exerted hydraulic pressure against the bulkhead, creating a resultant upward force which lifted the bulkhead. With the bulkhead clear from the tank top, the wheels could be rotated outwards and locked in position on the hatch coaming (Figures 1 and 3).

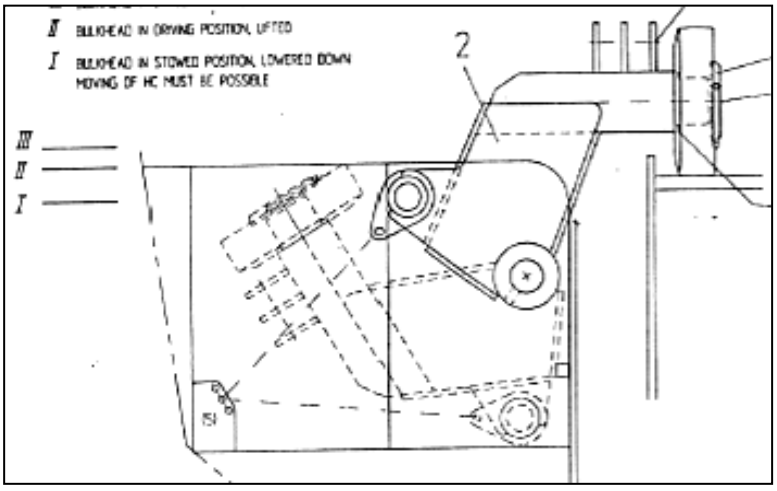

Figure 1: Bulkhead wheel arrangement (in the open position)

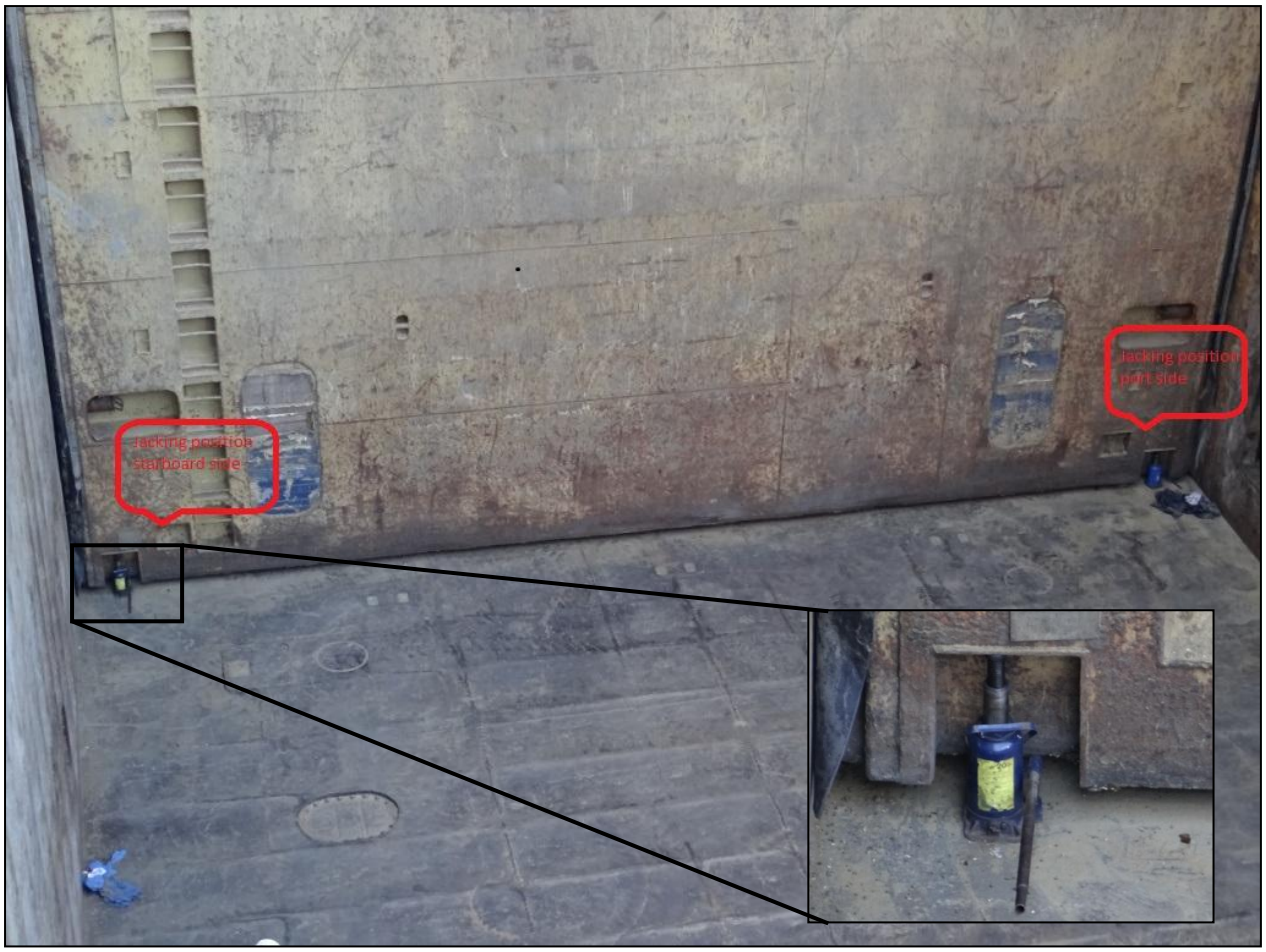

Figure 2: Hydraulic jacks in position to lift the bulkhead

Figure 3: Wheels locked on the cargo hold coaming

With the wheels fitted and locked in position, the jacks' hydraulic pressure could then be released and both jacks removed. The bulkhead would remain suspended on the wheel arrangements, which therefore, took the full weight of the bulkhead. In this position, the clearance of the lower part of the bulkhead from the tank top would be in the region of about 5 cm.

The portable bulkhead is transferred to the desired position along the length of the cargo hold, by connecting a link to the cargo hold hatch covers (Figure 4). Once the portable bulkhead reaches the desired position, it is locked by side securing bolts. Hydraulic jacks are used again to lift it and retract the wheels. The hydraulic jack pressure is then bled in a controlled manner so that the bulkhead will eventually rest on the tank top in the cargo hold.

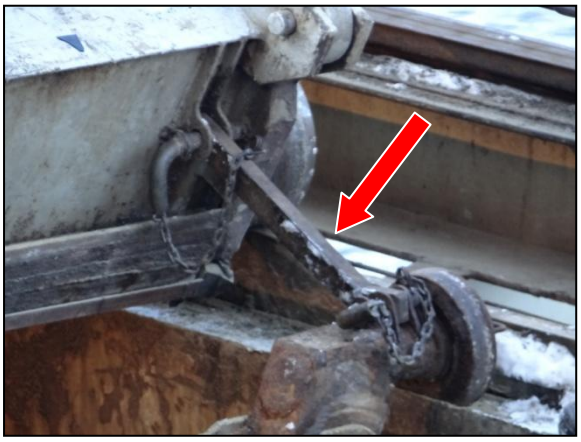

Figure 4: Link between the hatch cover and the portable bulkhead wheel arrangement

On this particular occasion, the bulkhead was raised as per normal procedure and the wheel arrangements extended on both sides. The hydraulic jacks were removed and the shifting operation initiated. Initially, after the wheel arrangements were linked to the cargo hold hatch cover, the system could not move and the crew members decided to use the on board compact loader (Bobcat), to move the hatch covers[1].

The intervention was successful and the cargo hatch covers were moved, hence shifting the portable bulkhead. However, the bulkhead was only shifted by a few metres, when the system came to a halt.

A closer inspection of the system revealed that the wheel on the port side of the portable bulkhead had slipped of its shaft. As a result of this, the bulkhead dropped by about 3.5 cm. It was also observed that the bulkhead was not at right angles to the tank top but was slightly tilted towards the direction of movement.

Seeing this, the crew members decided to lift the bulkhead again with the hydraulic jacks. The plan was to provide enough clearance to allow them to reinstall the wheel. In order to get the bulkhead in an upright position, the compact loader was used. At the same time, the AB was operating the hydraulic jack.

The bulkhead was eventually lifted to create enough clearance for the wheel to be reinserted. At this stage, without any warning, the bulkhead tilted backwards and fell from the hydraulic jack. The hydraulic jack was also displaced and the bulkhead landed on it and consequently it toppled on the AB's foot (Figure 5), although bearing partial weight of the bulkhead.

Figure 5: A crew member showing how the injury happened (during the accident, the portable bulkhead fell on the hydraulic jack)

[1] At the time, the master, chief engineer, chief mate, one AB, and one motorman were on the main deck whereas one AB and the second mate were inside the cargo hold.

Sustained injuries

Following several attempts, the injured crew member's foot was freed after about 30 minutes. The crew member was transferred to a local hospital where he was diagnosed with a fractured distal and middle phalange. His injuries required surgical interventions and were serious enough to necessitate the amputation of the third toe. The crew member eventually recovered and was repatriated after several days.

Manning arrangements at the time of bulkhead movements

The MSIU did not come across any documents, which stipulated the manning required to shift the bulkhead. It would appear that the manning level was more based on the experience of the crew members. However, as indicated in Figure 6, at the time of the accident, there were seven crew members on the deck and inside the cargo hold[2].

The crew members involved were well experienced with the bulkhead operations. Available evidence suggested that the bulkhead was shifted about 10 times in 2015.

Cause of the accident[3]

The immediate cause of the accident was the tilting of the bulkhead at a vulnerable time when the structure was being supported by the hydraulic jacks and not secured by its securing bolts. The operation of the hydraulic jacks necessitated at least one crew member to be in close proximity of the hazard.

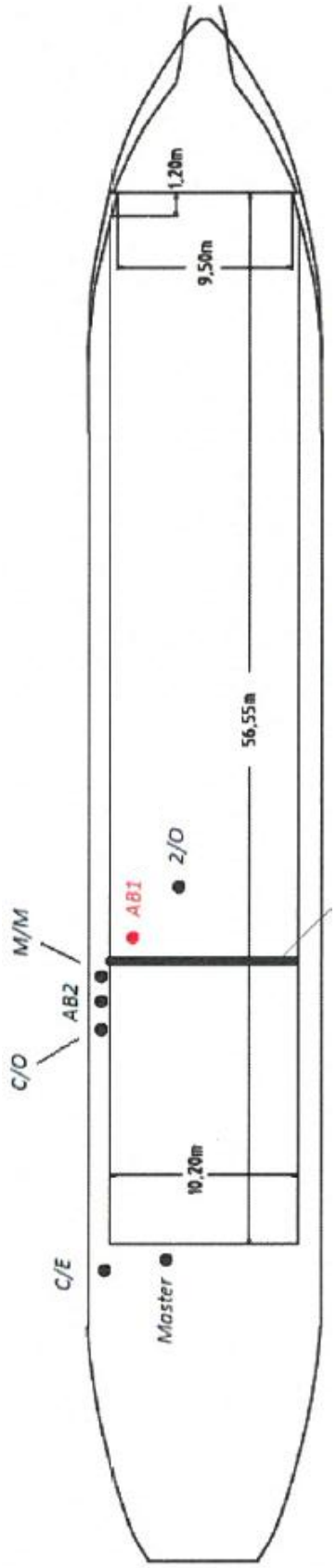

Figure 6: Position of crew members during at the time of the accident

[2] The vessel was manned by nine crew members. The injured crew member is identified as 'AB 1' in Figure 6.

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

At the time of the accident, the portable bulkhead was not secured because it was in an intermediary position. This was considered to be a barrier system which was missing during a high risk operation.

Bulkhead maintenance

The inspection carried out by the crew members soon after the wheel failed, revealed that the bolt securing the wheel to the shaft had failed. It was also not excluded that the wheel bearing was damaged. The Company confirmed that the maintenance of the wheel arrangement as part of the vessel's planned maintenance schedule was neither detailed nor specific. The failure of the bolt was also not detected during the crew members' routine inspections on board. It may be concluded that the exclusion of the wheel assembly from an effective preventive maintenance regime led to a missing critical process to ensure that reliability was not compromised over a period of time.

Bulkhead movement

The bulkhead movement was more complex then possibly anticipated, following the failure of the wheel. The tilt of the bulkhead in the direction of the movement was what actually compounded the problem. It may be hypothesised that the cause of the tilt was caused by residual hydraulic pressure in the mechanism, which had not been released prior to the insertion of the hydraulic jack and lifting of the bulkhead. It was therefore not excluded that this created a toppling moment when the bulkhead was clear off the tank top.

Although it seemed clear that the crew members knew exactly the procedure to reinsert the wheel, it was not clearly evident that the procedure was being coordinated by one of the senior crew members, although the MSIU has confirmed that the master was on the deck and was in charge of the operation. This was considered crucial because of the inherent risks involved in the shifting of the bulkhead.

Moreover, the process to shift the bulkhead necessitated that members of the crew expose themselves to the dangers inherent in the system. Installing the hydraulic jack at the foot of the structure required the crew members to enter inside the cargo hold. Whilst, as already indicated, the crew members were unable to insert the side pins because the bulkhead was in an intermediary position, no additional temporary holding supports were fitted at the upper end before it was raised by means of the hydraulic jacks.

Risk assessment

During the course of the safety investigation, it was confirmed that the operations linked to the portable bulkheads were not supported by a risk assessment.

The fact that a risk assessment was not conducted should not be analysed only in terms of the risk associated with the actual movement / shifting of the bulkhead.

Any piece of equipment, irrespective of the design criteria applied, will neither remain safe nor reliable if it is not maintained. Risk-based maintenance is a philosophy (and practical approach) which is developed to make use of failure knowledge (obtained either proactively or reactively) to inspect what may be classified as high-risk components. With a risk-based maintenance approach, inspections will be more frequent and thorough to ensure that the equipment's reliability is not compromised.

However, the risk-based maintenance philosophy comprises two main phases, *i.e.* risk assessment and maintenance planning based on risk. The framework incorporates hazard analysis to identify the failures scenarios, based on, *inter alia*, the operational characteristics of the system and the physical conditions under which the operations occur.

The absence of a risk assessment may have not reflected the spirit of the ISM Code and related safety management system practices with respect to safety critical conditions. However, what was more of a concern to the safety investigation was what seemed to be an unclear understanding that actually, safety and maintenance are not mutually exclusive functions.

SAFETY ACTIONS TAKEN DURING THE COURSE OF THE SAFETY INVESTIGATION[4]

Following an internal investigation in accordance with section 9 of the ISM Code, the Company took the following safety actions:

- Inspections routines on the portable bulkhead were implemented as part of the Company's electronic maintenance system;
- Prior to rectification of defects which would necessitate shifting the bulkhead, the crew members are being instructed to ensure that it was upright and that there were no external moments acting on it before the shifting operation was commenced;
- Routines for risk assessments on board Company vessels were enhanced;
- A new procedure has been introduced which requires that in cases of similar damages to the wheels and when it is not possible to prevent the bulkhead from moving, a shore crane is hired to lift the moveable bulkhead in a safe manner.

RECOMMENDATIONS

Taking into considerations the actions taken by the Company, no recommendations were made as a result of the safety investigation.

[4] **Safety actions should not create a presumption of blame and / or liability.**

SHIP PARTICULARS

Vessel Name:	*Hagland Borg*
Flag:	Malta*
Classification Society:	DNV GL
IMO Number:	9173563
Type:	General Cargo
Registered Owner:	Hagland Bulk Transport KS
Managers:	Hagland Shipping A. S.
Construction:	Steel
Length Overall:	87.99 m
Registered Length:	81.85 m
Gross Tonnage:	2456
Minimum Safe Manning:	9
Authorised Cargo:	Dry bulk

VOYAGE PARTICULARS

Port of Departure:	Helland, Norway
Port of Arrival:	Karlshamn, Sweden
Type of Voyage:	Short international
Cargo Information:	In ballast
Manning:	9

MARINE OCCURRENCE INFORMATION

Date and Time:	28 December 2015 at 2230 (LT)
Classification of Occurrence:	Serious Marine Casualty
Location of Occurrence:	Port of Karlshamn, Sweden
Place on Board	Cargo hold
Injuries / Fatalities:	One serious injury
Damage / Environmental Impact:	None reported
Ship Operation:	Alongside / moored
Voyage Segment:	Arrival
External & Internal Environment:	Dark, Southeasterly wind force 7, no swell. Overcast weather and an air temperature of 6 °C
Persons on board:	9

* The vessel was cancelled from the Register of Maltese ships on 27 January 2016 at the request of the owners.