Marine Safety Investigation Unit

Transport Malta

SAFETY INVESTIGATION REPORT

202004/016 REPORT NO.: 08/2021 April 2021

TUGBOAT *SPINOLA*

Serious injury to crew member, while berthed at Timber Wharf, Malta 13 April 2020

SUMMARY

Spinola's rescue boat cover required replacement and two crew members from tugboat *Lieni* were tasked with the job.

To facilitate the task, one of the crew members stepped on the unprotected outboard side of the rescue boat. At this time, he attempted to slacken the tension on the lifting slings holding the rescue boat. As soon as he operated the yellow handle, the rescue boat swung outboard, struck the crew member, and threw him onto the wharf.

The safety investigation concluded that the crew members did not have the intention to slew the rescue boat.

The MSIU has issued three recommendations to the Company designed to ensure familiarity with the rescue boat's launching system and reduce the hazards while preparing the boat for launching/recovery.

Tug *Spinola*

FACTUAL INFORMATION

Tugboat *Spinola*

Spinola, was a 701 gt Maltese-registered escort tugboat (Figure 1) built by Armon Shipyards, Spain, in 2009. She was owned and managed by Tug Malta Limited and was classed with RINA.

Spinola had a length overall of 36.65 m, a moulded depth of 4.80 m and a maximum beam of 13.60 m. Her designed maximum draft was 6.60 m. The vessel was equipped with firefighting and oil recovery equipment.

Propulsive power was provided by two MAK 8M25 engines, each developing 2,640 kW at 750 rpm. These drove two Voith Schneider propellers of type 32 R5/265-2. The tugboat had a maximum speed of 14 knots and had a bollard pull of 81 metric tonnes.

Crew

At the time of occurrence, the tugboat had not been assigned any crew members. The two persons carrying out the task on board *Spinola* were Maltese nationals and crew members on tugboat *Lieni*.

The master had a total of five years at sea. He had obtained his STCW[1] II/2 chief mates' Certificate of Competency in 2015. He had been issued with an equivalency letter in December 2018, enabling him to work as a master (without limitations) in local waters, in accordance with the Commercial Vessels Regulations, 2002.

The master started working with the Company in March 2018. For the period of this employment up to the time of occurrence, he was engaged on various tugboats smaller than *Spinola*, and he was yet to be inducted on the handling of *Spinola*. On the day of occurrence, the master had started work at 0530. He had not been assigned any work on the previous day.

The injured seafarer was working as a general-purpose hand (GPH) with the Company for around 18 years. He had a total of 20 years seagoing experience. He had obtained his Commercial Vessel GPH certificate in July 2004. On the day of occurrence, he had started work at 0600. He had not been assigned any work on the previous day. At the time, the GPH was wearing his safety shoes as part of his personal protective equipment (PPE).

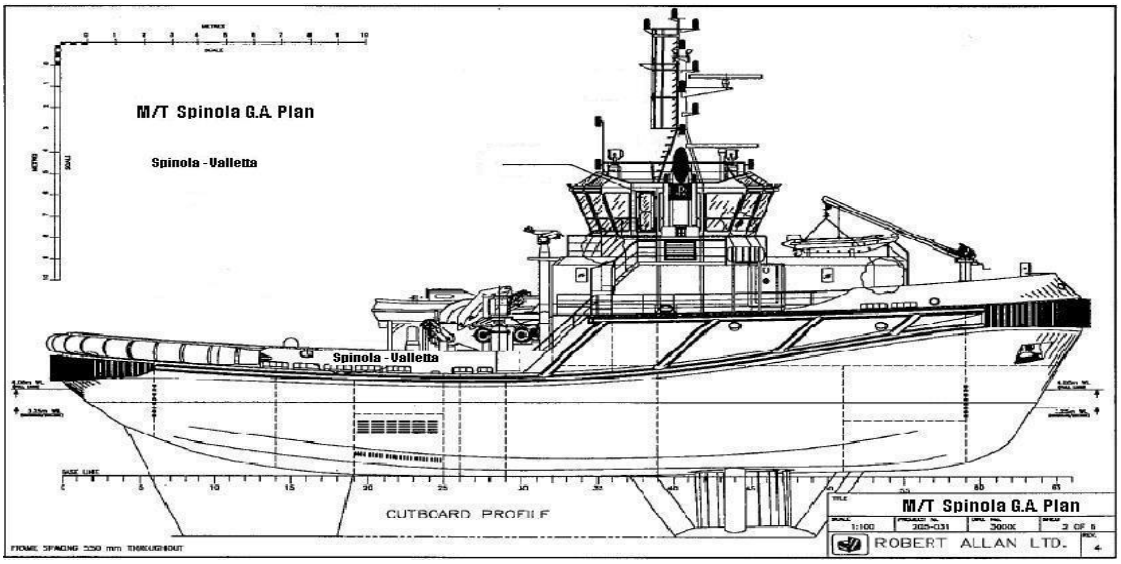

Figure 1: Tugboat *Spinola* GA plan

[1] IMO. (2010). The Manila amendments to the annex to the International convention on standards of training, certification and watchkeeping for seafarers (STCW), 1978. London: Author.

Environment

The weather on 13 April 2020 was clear with a visibility of about 20 nautical miles. The wind was variable, and the sea state was calm. The air and sea temperatures were recorded as 20 °C and 19 °C, respectively.

Narrative[2]

On 13 April 2020, the master and the GPH were working on the morning shift on board tugboat *Lieni*, along with an engineer. *Lieni*, which is also owned by the same owners, was berthed alongside *Spinola* at Timber Wharf in Marsa. *Spinola* was unmanned. At around 1245, the Company's assistant superintendent boarded *Lieni* and instructed the crew members to replace the existing rescue boat cover on board *Spinola* with a new one, since the old one was torn at some places.

The master instructed the GPH to collect the new rescue boat cover[3] from the workshop, which was close to the wharf, and take it to *Spinola*. Thereafter, the master went on board *Spinola*. Once the GPH arrived on *Spinola*, he and the master began removing the lashing straps and the old cover from the rescue boat (Figure 2).

Figure 2: Lashing straps marked in green. Inset indicating the location of one of the securing for the lashing hook (the grey cover is the new cover)

To gain access to the lashings, the GPH proceeded to the outboard side of the rescue boat and stepped on the drenching curtain pipe, which ran around the deck (Figure 3). The old cover was removed without difficulty, following which, the GPH returned to the inboard side.

Prior to installing the new cover, the master and the GPH discussed its correct position and how to proceed to fit it. They were aware that the new cover had an opening to accommodate the release hook and the attached lifting slings.

The crew initially attempted to fit the new cover from the inboard side, however, they agreed that someone had to return to the outboard side to facilitate the fitting. The GPH went back onto the drenching curtain pipe to be able to proceed with the task.

Figure 3: The master's position (red) and the GPH's position on the outboard side (blue)

Their plan was to ease the tension on the hoisting arrangements, disengage the release hook, pass the lifting slings through the new cover's opening and then re-attach the release hook. The GPH pulled down on the remote control for lowering (Figure 4) while

[2] Unless otherwise specified the times referred to in this report are local time (UTC + 2).

[3] The new cover was manufactured identically to the old cover and the only reported difference was the colour.

the master applied weight on the lifting slings, however, they did not get any results.

Figure 4: Remote control for lowering (red) and remote control for slewing (yellow)

It was reported that the crew members thought that they had pulled on the incorrect handle to release the brake. At around 1300, the GPH then pulled the other handle and consequently, the jib's crane swung outboard with the rescue boat, dragging the GPH along with it in the process.

CCTV footage of the wharf, which captured the accident, indicated that the GPH was pushed horizontally with the rescue boat for a short distance and then fell onto the wharf. He was found at the edge of the wharf, close to the tug's bulwark (Figure 5).

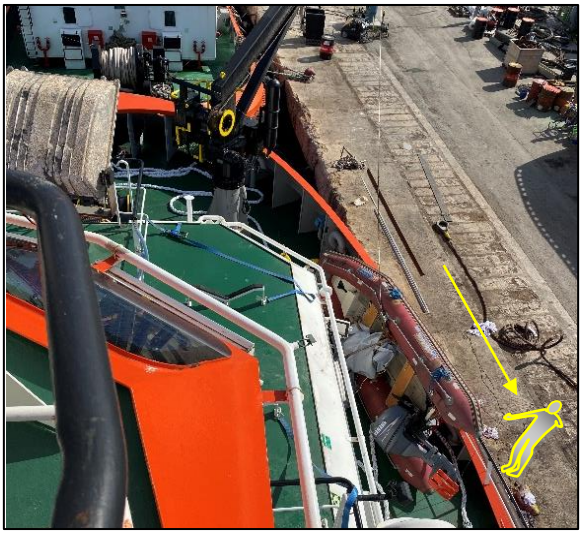

Figure 5: Final position of rescue boat after the swing and approximate landing position of the GPH on the wharf

As soon as the master realized what happened, he sped to his aid. He then called for medical assistance and remained next to the GPH until an ambulance arrived on site.

Injuries suffered by the GPH

As a result of this occurrence, the GPH suffered from fractures to his left patella and left wrist. He had also suffered from a broken nose and several lacerations to his nose. He underwent surgery and physiotherapy and was later discharged from hospital on 22 April 2020, although he still required further medication.

The GPH reported that he had no recollection of the events surrounding the accident.

After the accident

The Company was notified of the accident and soon after, personnel from the Company went on board the tugboat. The following was observed:

- the rescue boat fell on its port side on the forecastle deck, with the new cover still on it;
- the release hook was still locked, and the safety pin inserted;
- the left rear lifting sling of the rescue boat was found unattached to the hull of the rescue boat;
- the slewing lever at the local control station was found stuck in the slewing position, with its lever boot damaged; and
- the davit's main wire rope was found slack.

***Spinola*'s rescue boat and davit system**

The tugboat's rescue boat was stowed on the starboard side, on the bridge deck. It rested on a cradle and was fenced by safety railings to its inboard side. For launching and recovery purposes, *Spinola* was fitted with a rescue boat handling davit system, which was

installed on the forecastle deck and which was certified under the SOLAS[4] Convention requirements.

The davit's slewing movements could be operated from the local station, at the davit's control platform (Figure 6), as well as by a remote system, consisting of a yellow control handle that could be operated from the inside of the rescue boat (Figure 4).

Figure 6: Davit's local controls – slewing control in yellow and brake mechanism in red

The maximum slewing angle of the davit was 270°. A 90° angle in a left-hand direction could be achieved with stored power.

The launching of the rescue boat was possible by gravity. The rate of descent could be controlled either with the application of the brake at the davit's controls (Figure 6), or remotely by pulling down the red control handle for lowering from inside the boat (Figure 4). For recovery of the rescue boat, the davit was fitted with an electrically powered winch. The rescue boat launching instructions poster was attached to the davit arm, close to the local control station of the davit.

Figure 7 shows the hydraulic pack schematic drawing.

Slewing of the davit was possible by means of hydraulic motor (50) mounted on the davit, close to the hoisting/lowering winch. An accumulator (32) (also seen in Figure 6) was also mounted on the davit and drove the hydraulic motor, as soon as the slewing lever was actuated. A hydraulic power unit ((4) and (5)) was activated by a pressure control switch (10) within the accumulator. When the pressure dropped to the pre-set value, the electric motor would start and drive the hydraulic pump to charge the accumulator until the pre-set pressure is reached.

Th hydraulic control valve (12) was also designed to reverse the slewing direction, (*i.e.*, either launch or recovery of the rescue boat), depending on the operational direction of the control valve (either connecting  or ). However, the operation of the hydraulic control valve from the remote station (the rescue boat deck) was only in one direction and it was only possible to launch the rescue boat.

According to the davit's operating manual, the hydraulic circuit had to be kept isolated by means of ball valve (15), which had to be opened prior to operating the slewing lever. On board *Spinola*, this ball valve was always kept open.

[4] IMO. (2019). International convention for the safety of life at sea (SOLAS), 1978, as amended. London: Author.

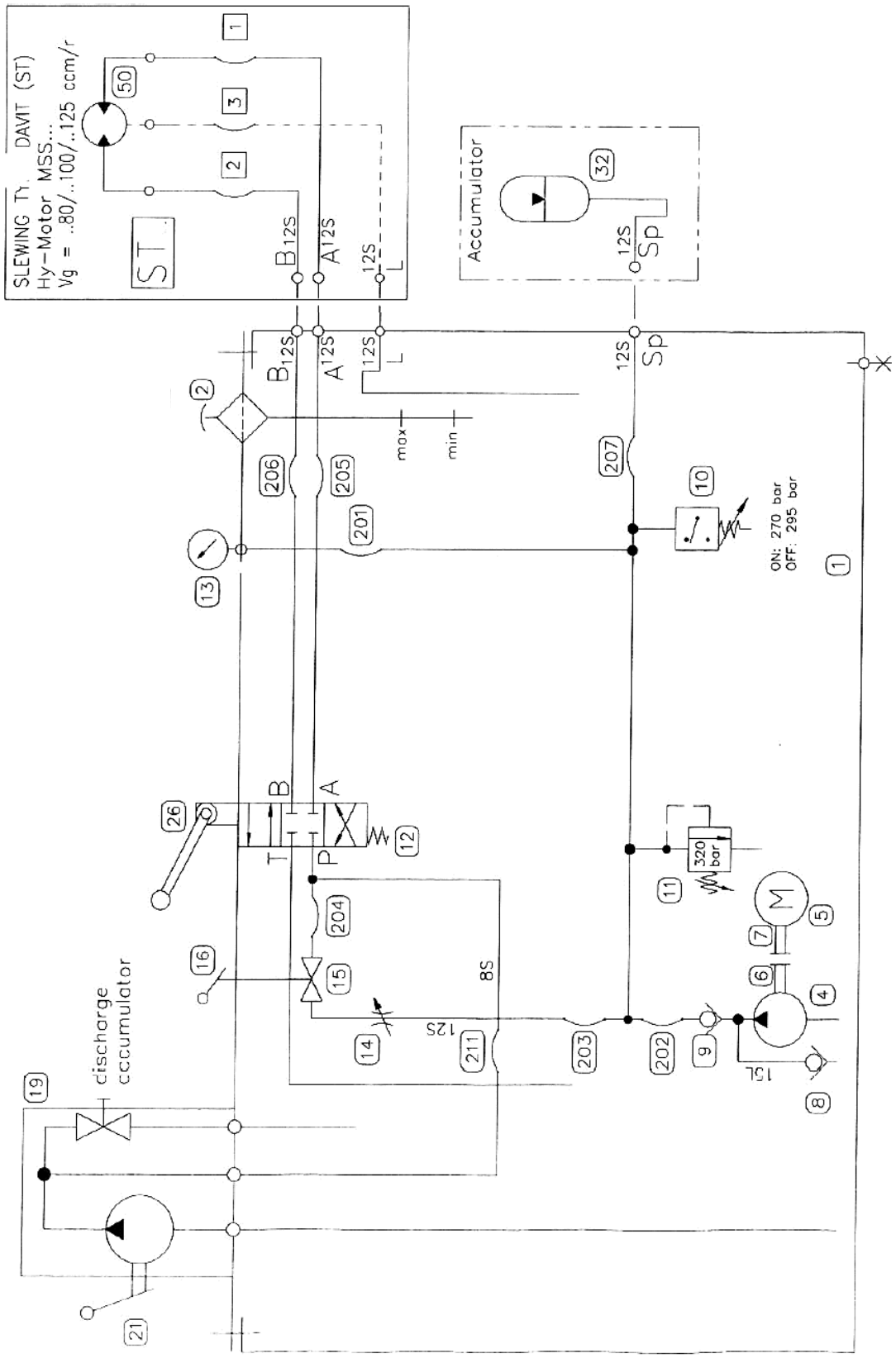

Figure 7: Rescue boat hydraulic pack diagram

Source: d-i davit international gmbh Operations Manual

ANALYSIS

Aim

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 or incidents from occurring in the future.

Immediate cause of the accident

Since the GPH was standing on the outboard side of the rescue boat, when the rescue boat swung to starboard, the GPH lost his footing, was dragged with the swinging rescue boat for a short distance and fell onto the wharf.

Fatigue

Both the GPH and the master had the 12th of April off. The MSIU could not confirm the quality of their rest; however, signs of fatigue were not reported to this Unit and therefore, fatigue was not considered as contributory to this occurrence.

Accident dynamics

At the first instant, the GPH proceeded to the outboard side of the rescue boat to be able to release the lashings which were secured on that side. It was known to the crew members that the old cover incorporated a zipper which eased the handling process. In fact, the old cover was removed without any difficulties.

When it came to the installation of the new cover, the crew members decided to lower the release hook, disengage it and pass the lifting attachments through the opening in the cover and re-attach everything again. The safety investigation revealed that this different approach was taken because the crew did not notice the zipper on the new cover. At that time, their understanding was that the only way to fit the cover on the rescue boat was by disengaging the release hook and passing it through the cover's opening.

The safety investigation believes that the crew members' understanding may have been conditioned because the zipper was covered by a flap, which was an extension of the cover (Figure 8). Consequently, the zipper went unnoticed. It may be suggested that in all probability, the crew members were not aware that the cover was identical to the one that they had already removed; this may have necessitated the crew members to improvise on a method to fit the new cover.

Figure 8: New cover's flap

It was stated that the GPH had first pulled down on the remote control for lowering and the master was assisting by pulling down on the lifting slings. However, nothing was observed to happen. While taking into consideration that the lowering of the rescue boat is executed by gravity, a weight (usually the rescue boat itself) would be necessary for gravity forces to take effect. In this case, it may be suggested that the downward force applied by the crew was insufficient to lower the release hook by itself.

However, it was also noted that the rescue boat had fallen from the bridge deck to the forecastle deck, a height of approximately two metres. This suggested that the rescue boat's wire was slack enough to allow the drop of the rescue boat to the forecastle deck. The MSIU believes that when the GPH was tugging on the remote control for lowering

(red handle), the wire was being slackened, but somehow, this went unnoticed by the crew members. It is probable that the wire was slackening around its drum (which was located behind the davit's structure).

Observing that nothing had happened after pulling on the remote lowering handle, prompted the crew to assume that they had pulled the wrong handle. This led the GPH to (erroneously) pull the remote-control handle for slewing, which activated the slewing mechanism of the davit and resulted in the rescue boat swinging outboard, dragging the GPH along with it.

Assessment of risk

The task assigned to the crew members was considered by the Company to be straight forward and simple. As the rescue boat's cover was normally handled during drills and training activities, a risk assessment was not considered as necessary for this task.

The GPH opted to go outboard of the rescue boat's railings to be able to remove the lashings from that side and to place the cover around the rescue boat's extremities. When consulting with the Company, it was revealed that although no written procedures had been established, crew members were expected to stay on the inboard side of the railings. However, after the accident, the Company also became aware that several crew members position themselves on the outboard side for this task.

For crew members (like the GPH) who opted to walk outboard, the tugboat's drenching curtain piping served as a foothold to stand upon (Figure 9). As such, the safety investigation believes that due to the (perceived) trivial nature of this task, and the relatively short time standing on the curtain piping, wearing a safety harness was not deemed necessary by the crew members.

It was reported that while the GPH was wearing safety shoes as part of his PPE, he had not been wearing a safety helmet. It was probable that, although the height of the GPH's fall was considerable, a strapped safety helmet may have minimized the severity of his head injuries.

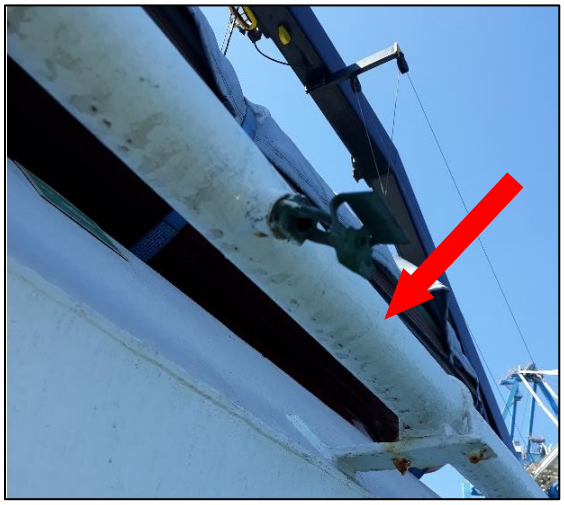

Figure 9: Drenching curtain piping used by crew members while on the outboard side of the rescue boat, seen from below

Familiarisation with equipment

As mentioned elsewhere in this safety investigation report, the master was still to be inducted on board *Spinola*. On the other hand, the GPH had served with the Company for 18 years and had worked on *Spinola* on numerous occasions, prior to the occurrence.

Given that the GPH pulled the yellow slewing handle, after he pulled the red lowering handle and observed that the wire had not slacked, the safety investigation believes that the GPH may have been unsure of the functions of the remote controls of the rescue boat. This is a typical (rule-based)[5] behaviour, indicative of uncertainty while operating a machine/piece of equipment and an action does not lead to the expected outcome.

[5] Rule-based level behaviour is normally applied in situations where strong (if / then) rules apply. If the situation is misclassified, either a wrong rule is applied, or procedures are not recalled correctly. *Vide*: Reason, J. (1990). *Human error*. Cambridge: Cambridge University Press.

It was later revealed that during training activities and drills, the launching of the rescue boat had always been controlled from the davit's local controls, by an engineer.

Launching instructions

The rescue boat's launching instructions, contained within the Class approved davit's instruction manual, were posted on the davit's arm, close to the local control station (which was situated on the forecastle deck) to be seen by the davit's operator. It did not transpire to the safety investigation that these instructions were posted in the proximity of the crew members working on the rescue boat on the bridge deck's location[6].

Being an important incorporeal barrier system[7], the available instructions on board did not clearly identify the functions of each remote-control handle. Therefore, the effectiveness of the instructions on the crew members engaged in the task would have been, at best, limited.

Ball valve (15)

The davit's operations manual indicated that ball valve (15) for the hydraulically operated slewing system had to be kept closed when not in use. Moreover, the launching procedures within the operations manual specified that this ball valve had to be opened before the slewing mechanism can be operated and closed once recovery procedure of the rescue boat has been complete.

As indicated in Figure 7, ball valve (15) was fitted in the supply line. Therefore, once closed, the hydraulic circuit to the slewing motor would be isolated at the valve and slewing movement would not be possible. Although not specified in the operations manual, the MSIU believes that ball valve (15) had been fitted for at least two main reasons *i.e.*, to avoid accidental slewing of the davit and for maintenance purposes on the system.

The safety barrier system was a composite one, including a combination of technical, human and incorporeal barriers, aimed at protecting the system user from adverse outcomes. Ball valve (15) was a functional barrier[8] which, although physically present, necessitated an operational intervention to function, if maintained as stipulated in the operations manual. Its physical status *vis-à-vis* the requirements in the operations manual was considered to have played a critical role in how the dynamics of the accident had developed.

A prima facia, one could argue that had the valve been kept closed, the accident would have likely been avoided because there would have been no hydraulic power to the davits slewing motor. However, with ball valve (15) always open, the crew members ensured immediate readiness of the system in case of an emergency. In an emergency, time is of essence and not necessarily available for the crew members to proceeded to the forecastle deck, open the ball valve, and return to the boat deck to deploy the rescue boat.

Academic research in safety barrier system failure identified several reasons behind this. The design of the procedures was a major factor, potentially resulting in an ineffective barrier system[9]. The attributed failure is two-fold.

First and foremost, procedures may give priority to the quality of the product rather than safety. For instance, the availability of

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6 This is a SOLAS requirement, prescribed in regulation III/9.

7 Typical incorporeal barrier systems would include rules, guidelines, laws, instructions, *etc*.

8 A functional barrier effectively sets up one or more pre-conditions (open ball valve) that must be met before something could happen (in this case, the slewing movement of the davits).

9 For a more detailed discussion *vide* Hollnagel, E. (2000). When all things fail. *Cognition, Technology & Work, 2*(4), 221-223.

ball valve (15) provided redundancy against hydraulic leakage (at least to part of the system), prevented accidental slewing (to a certain extent) and enabled maintenance on the system. The implications of keeping ball valve (15) closed (as prescribed in the procedures) have already been discussed and the potential compromise to timely actions by crew members in an emergency have already been mentioned elsewhere in this safety investigation report.

Secondly, in view of this potential issue, which was detected by the Company, an adaption to the operation manual had to be made and consequently, ball valve (15) was always being left open.

With ball valve (15) open, it was ascertained that the system was readily available; however, this front-line adaption also meant that ball valve (15) became an ineffective (functional) barrier.

Other findings

Although not having a bearing on the dynamics of the accident, it was noted that the rescue boat had turned on its port side when it dropped to the lower deck. This happened even though the rescue boat had four lifting slings at each corner of the hull to keep it upright.

During the safety investigation, it was revealed that the left, rear lifting sling had not been secured to the rescue boat's hull. While the reason behind this could not be confirmed, the safety investigation concluded that it had most likely contributed to the rescue boat turning to its left side before landing on the lower forecastle deck.

Additionally, the slewing lever at the local control station (26)[10] was found stuck in the slewing position with its dust boot damaged. A closer inspection did not reveal any mechanical damages which would have prevented the slewing lever from operating freely. It was therefore hypothesised that the probable cause of the sticking of the slewing lever was the pulling force applied by the GPH when he was being dragged over the side by the slewing rescue boat.

CONCLUSIONS

1. The davit's slewing mechanism was activated accidentally, causing the rescue boat to swing outboard, dragging the GPH along with it and resulting in a fall to the wharf.
2. A risk assessment was not considered necessary for this task.
3. The crew members decided to lower the release hook and disengage the rescue boat because they did not notice that the cover could be undone by unzipping it;
4. On two occasions, the GPH moved to the outboard side, where guard rails were not fitted.
5. A safety harness had not been worn when the work shifted to the outboard side of the rescue boat.
6. A safety helmet had not been worn by the GPH during this task.
7. As soon as it became evident that pulling the first handle had no effect, the second available handle was pulled, resulting in an unexpected slewing movement of the rescue boat.
8. The crew members were not entirely familiar with *Spinola*'s rescue boat davit operation.
9. During training sessions and drills involving the launching of rescue boats, only the engineers actuated the davit's controls and it was always carried out from the local control station.

[10] Reference Figure 7.

10. The ball valve (15) in the slewing system was always kept open to facilitate readiness of the rescue boat. This meant that ball valve (15) became an ineffective (functional) barrier, against an accidental slewing of the davit.

SAFETY ACTIONS TAKEN DURING THE COURSE OF THE SAFETY INVESTIGATION[11]

In order to avoid similar occurrences in the future, the Company has:

- carried out an exercise with its employees to review their knowledge and address any issues found with them;
- implemented a training programme / plan for both crew and shore-based personnel, to ensure that all its employees were trained accordingly;
- mapped a training gap analysis for its personnel and carried out in-house and third-party training;
- reviewed all risk assessments that were relevant to this accident;
- reviewed risk assessments of other tasks where a similar potential scenario could arise.

RECOMMENDATIONS

Tug Malta Limited is recommended to:

08/2021_R1 Apply either reflective tape or black & yellow warning tape on the cover zipper.

08/2021_R2 Fix comprehensive rescue boat launching procedures in the vicinity of the rescue boat.

08/2021_R3 Consult with the flag State Administration and the Classification Society on the installation of a remote operating mechanism, at the rescue boat launching position, for the slewing system ball valve (15).

[11] **Safety actions and recommendations shall not create a presumption of blame and / or liability**.

SHIP PARTICULARS

Vessel Name:	*Spinola*
Flag:	Malta
Classification Society:	RINA
IMO Number:	9495258
Type:	Tug
Registered Owner:	Tug Malta Limited
Managers:	Tug Malta Limited
Construction:	Steel
Length Overall:	36.65 m
Registered Length:	33.59 m
Gross Tonnage:	701
Minimum Safe Manning:	3
Authorised Cargo:	N/A

VOYAGE PARTICULARS

Port of Departure:	Marsa, Malta
Port of Arrival:	Marsa, Malta
Type of Voyage:	Internal waters
Cargo Information:	N/A
Manning:	Unmanned

MARINE OCCURRENCE INFORMATION

Date and Time:	13 April 2020 at 13:00 (LT)
Classification of Occurrence:	Serious Marine Casualty
Location of Occurrence:	Timber Wharf, Marsa, Malta
Place on Board	Bridge deck
Injuries / Fatalities:	One serious injury
Damage / Environmental Impact:	None reported
Ship Operation:	Alongside
Voyage Segment:	Arrival
External & Internal Environment:	Clear weather with calm seas. Variable light airs. Air and sea temperatures were recorded at 20 °C and 19 °C, respectively.
Persons on board:	Two