



**The Bahamas
Maritime Authority**

THE COMMONWEALTH OF THE BAHAMAS

M.v AMAZON
IMO Number: 9138616
Official Number: 732165



**Report of the investigation into a crew
fatality during an abandon ship drill on the 12th April
2016**

The Bahamas conducts marine safety or other investigations on ships flying the flag of the Commonwealth of the Bahamas in accordance with the obligations set forth in International Conventions to which The Bahamas is a Party. In accordance with the IMO Casualty Investigation Code, mandated by the International Convention for the Safety of Life at Sea (SOLAS) Regulation XI-1/6, investigations have the objective of preventing marine casualties and marine incidents in the future and do not seek to apportion blame or determine liability.

It should be noted that the Bahamas Merchant Shipping Act, Para 170 (2) requires officers of a ship involved in an accident to answer an Inspector's questions fully and truly. If the contents of a report were subsequently submitted as evidence in court proceedings relating to an accident this could offend the principle that individuals cannot be required to give evidence against themselves. The Bahamas Maritime Authority makes this report available to any interested individuals, organizations, agencies or States on the strict understanding that it will not be used as evidence in any legal proceedings anywhere in the world.

Date of Issue: 14th September 2016
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SUMMARY

- 1.1 On the 12th April 2016 the Bahamas registered bulk carrier Amazon was anchored at Constanta roads anchorage, Romania. At 12:05 (LT)¹, during a routine abandon ship drill, the Bosun of the vessel sustained a fatal injury inflicted by the crank-handle of the starboard side lifeboat (No. 1) davit winch, used for the manual hoist and recovery of the starboard lifeboat. At the same time, another crew member, the vessel's Oiler sustained a minor injury to his hip.
- 1.2 An electrical fault in the starboard winch switchboard resulted in the No.1 lifeboat being recovered manually using the crank-handle operated by the Oiler and Bosun under the supervision of the Master and 2nd Officer. While in the process of recovering the No.1 lifeboat from the water, the electrical power supply to the winch motor was restored causing the winch to rotate under power with the crank-handle connected. This resulted in the crank-handle rotating around the winch, striking the Bosun on the head.
- 1.3 The master control speed selection lever was initially engaged for a slow speed recovery, however due to there being no power available to the winch motor the speed selection lever was redundant up until the power was restored, at which point the motor rotated at a speed previously selected by the speed selection lever.
- 1.4 During the course of the investigation, it was determined that the limit switch which prohibits the winch motor from rotating when the crank-handle is in situ was out of order. With interlocking limit switches being bypassed at the switchboard, the designed safety features were no longer operable which compromised the safety of those crew members conducting the abandon ship drill.
- 1.5 The marine safety investigation identified multiple failings in the mechanical, electrical and procedural components of the abandon ship drill. The investigation further determined that during the course of the abandon ship drill, both active and latent failures existed. The analysis conducted has categorised these failures and provided recommendations to the Company to avoid future reoccurrence.

¹ Unless otherwise stated, all times quoted are local time.

2 DETAILS OF INVOLVED VESSEL(S) AND OTHER MATTERS

2.1 Vessel Details and Crew Particulars

2.1.1 The Amazon is an all welded, bulk carrier with five cargo holds and self-loading davits. The vessel is owned by Amazon Navigation Co. Ltd of Marshall Islands and managed by Tide Line Inc. of Greece. The principal details as at 12th April 2016 are as follows:

IMO No:	9138616
Official No.:	732165
Call Sign:	C6QI2
Builders:	1997, Guangzhou Shipyards in China
Class Society:	Nippon Kaiji Kyokai (ClassNK)
Gross Tonnage:	16,405 tonnes
Net Tonnage:	9,211 tonnes
Length Overall:	163.33 metres
Breadth:	25.00 metres
Summer Draught:	10.025 metres
Summer D.W.T.:	26,096 tonnes
Propulsion:	6L50MC x 1
Shaft Power:	4880.0 kW
Complement:	23

2.1.2 The vessel was first registered under the Bahamas Flag on 17th December 1998 and ClassNK was the Classification Society and Lloyds Register was the Recognized Organization. The vessel complied with all statutory and international requirements and certification.

2.1.3 At the time of the casualty, the vessel had a complement of 23 crew. The crew were made up of the following nationalities: Poland (1), Ukraine (10) and Myanmar (12). The vessel's Safe Manning Document (SMD) was issued by The Commonwealth of the Bahamas on the 1st February 2015. The vessel met the requirements of the SMD and was provided with 9 additional personnel.

- 2.1.4 The Master, a Ukrainian national held a Unlimited Master Mariner Certificate at the management level (II/2)² required by the International Convention on Standards of Training, Certification and Watchkeeping 1978, as amended (STCW) issued by the Ukrainian Maritime Authority and endorsed by the Commonwealth of the Bahamas on 16th January 2014, and was duly recognized in accordance with the provisions of Regulation I/10 of the STCW.
- 2.1.5 The Chief Officer, a Ukrainian national held a Chief Officer's Certificate, STCW II/2, issued by the Ukrainian Maritime Authority and endorsed by the Commonwealth of the Bahamas on the 11th July 2014 in accordance with the provisions of Regulation I/10 of the STCW.
- 2.1.6 The Chief Engineer, a Ukrainian national held STCW III/2 Chief Engineering Officer qualification at the management level, endorsed by the Commonwealth of the Bahamas on the 01 April 2016 and duly recognized in accordance with the provisions of regulation I/10 of the STCW.
- 2.1.7 The Bosun was from Myanmar and having spent more than 15 years at sea, initially as an AB and from 2007 serving in the capacity of Bosun. He joined the vessel for the first time on 30th January 2016.
- 2.1.8 The Electrician was also from Myanmar, having spent 9 years at sea and joined the vessel at the same time as the Bosun.
- 2.1.9 The Master and the Chief Officer had worked together previously in their respective positions and this was their second assignment on board Amazon. The Master joined the vessel on 7th January 2016, whilst the Chief Officer joined on the 17th November 2015, along with the 2nd Officer (who was inside the starboard lifeboat during the accident) the Oiler (who sustained minor injury by the crank-handle). The other 2nd Officer (who was on the boat deck prior the casualty) and one AB (located in the starboard lifeboat during the casualty), both joined the vessel on the 30th January 2016.
- 2.1.10 The Company reported that all crewmembers had completed their on-board familiarisation on joining the vessel in accordance with the Company's Safety Management System (SMS).
- 2.1.11 The crewmembers were wearing the personal protective equipment specified in the Company's procedures during the execution of the drill.

2.2 Port State, Flag State and Class Inspections

² Specification of minimum standard of competence for Masters and Chief Mates on ships of 500 gross tonnage or more.

- 2.2.1 The last Port State Control (Paris-MoU) inspection was carried out by the Swedish Transport Agency in Norrköping, Sweden on the 23rd February 2016 with no deficiencies recorded.
- 2.2.2 The last Bahamas Annual Safety Inspection (ASI) was carried out also on the 23rd February 2016 in Norrköping, Sweden with no deficiencies recorded.
- 2.2.3 The vessel fulfilled the required surveys mandated by the International Conventions and as described under the Harmonised System of Survey and Certification A.1053(27) as amended with the following completion dates:

Special Survey	Jan 2013
Intermediate Survey	Apr 2015
Annual Survey	Feb 2016

The next special survey and dry-docking is scheduled in December 2017.

- 2.2.4 In addition to the Bahamas ASI, ClassNK also conducted an annual survey on the 23rd February 2016. During the course of the survey the starboard lifeboat was launched, sea trialled and recovered satisfactorily and safety equipment certificate issued. However, two unrelated operational deficiencies were identified as possible Safety Management System failures resulting in the issuance of an IACS PR-17 Form³. The two identified deficiencies were deemed significant enough to warrant the attention of the vessel's Safety Management Certificate (SMC) issuing authority.

2.3 Fatigue

- 2.3.1 All watchkeepers on duty during the 0800 - 1200 and 1200 - 1600 watches, were, according to on-board records, in compliance with the statutory hours of rest requirements⁴.

2.4 Substance Abuse

- 2.4.1 Although no alcohol testing was carried out following the casualty, there was no evidence to suggest that substance abuse was a contributory factor.

2.5 Description of the lifeboats' launching and recovery arrangements

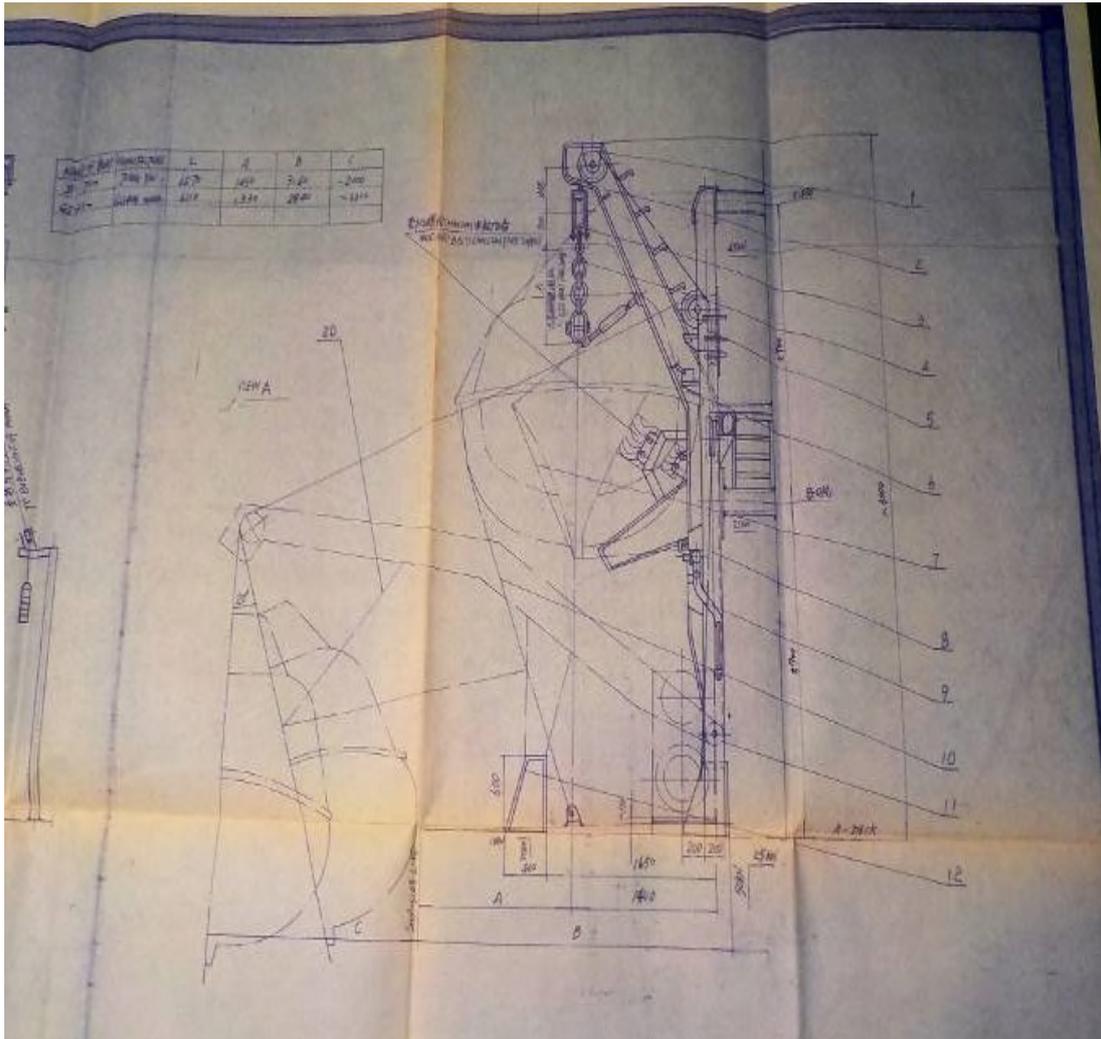
- 2.5.1 The vessel is fitted with one (1) 30 person totally enclosed lifeboat located on each side of the accommodation block. The starboard side lifeboat (No. 1) is the designated rescue boat of the vessel. Lifeboat launching and

³ FORM-IACS-PR-17: Reporting by surveyors of deficiencies relating to possible Safety Management System failures and the subsequent action to be taken.

⁴ In compliance with the Maritime Labour Convention 2006, as amended, in particular regulation 2.3 prescribing hours of work or rest.

recovery arrangements are identical on both sides of the ship with davits and electrical winches installed on the port and starboard boat decks.

- 3.5.2 The lifeboat davits (LE 65-2) are of the hinged-type incorporating a luffing arm design. They are freestanding and deck mounted, designed to swing-out by a single pivot movement and lower the lifeboat by gravity⁵. The launching/lowering action can be operated either from inside the lifeboat or from the boat deck.



1. Head tackle
2. Davit Arm
3. Floating block
4. Boat fall unit
5. Boat fall unit& tackle

⁵ Gravity type davits are launching devices using boat falls and lowering winches. Crewmembers can get on board at their storage positions, and lifeboats can be drawn out and lowered to alight on water by remote controls operated from inside the lifeboats. The speed at which the lifeboats are lowered by their own weight is maintained within a fixed range, and can be stopped at the desired position.

6. Limit unit
7. Fastening unit
8. David frame
9. Stop unit
10. Gripes (chock) lashing
11. Pivot unit
12. Support
13. Bracket
20. Guy system

Figure 1: Lifeboat davit schematic (type LE 65-2) assembly and main components

- 3.5.3 The LE 65-2 davit installation comprises of several mechanical units as well as safety interlocks (mechanical and electrical) to facilitate safe launch and recovery operations. The arms of the davit (figure 1) act as jibs for lifting or lowering the lifeboat and supported on the frame through pivots.
- 3.5.4 Each LE 65-2 davit is coupled with an electrically driven winch (type DZB Z/Y 63/30) used to hoist and recover the lifeboat to its secured inboard position and equipped with a reduction gear, non-return clutch, governor, gravity speed limit brakes and a hand brake lever. The davits and winches were manufactured by Zhenjiang Marine Auxiliary Machinery Works, China.
- 3.5.5 The starboard lifeboat winch has the following main components (see figure 2):
- a. Built-in electric motor which drives a wire-drum for the hoisting and recovery of the lifeboat;
 - b. Double winch drum (two drums D1-D2 on two sides of reduction gearbox);
 - c. Reduction gear unit fitted in a closed gear casing, incorporating a conventional gear train and an automatic centrifugal clutch (fitted between the electric motor and the high-speed shaft). The action clutch-in or clutch-out between the gear box and electric motor shall be joined together when the electric motor turns and separated away (shaft is automatically separated from the reduction gear) when the electric motor stops;
 - d. Speed limit / brake unit, incorporating a centrifugal speed limiter for gravity lowering and a stop brake mechanism (of “dead-man” type) which engages through the operation of a hand brake lever (bob-weight).

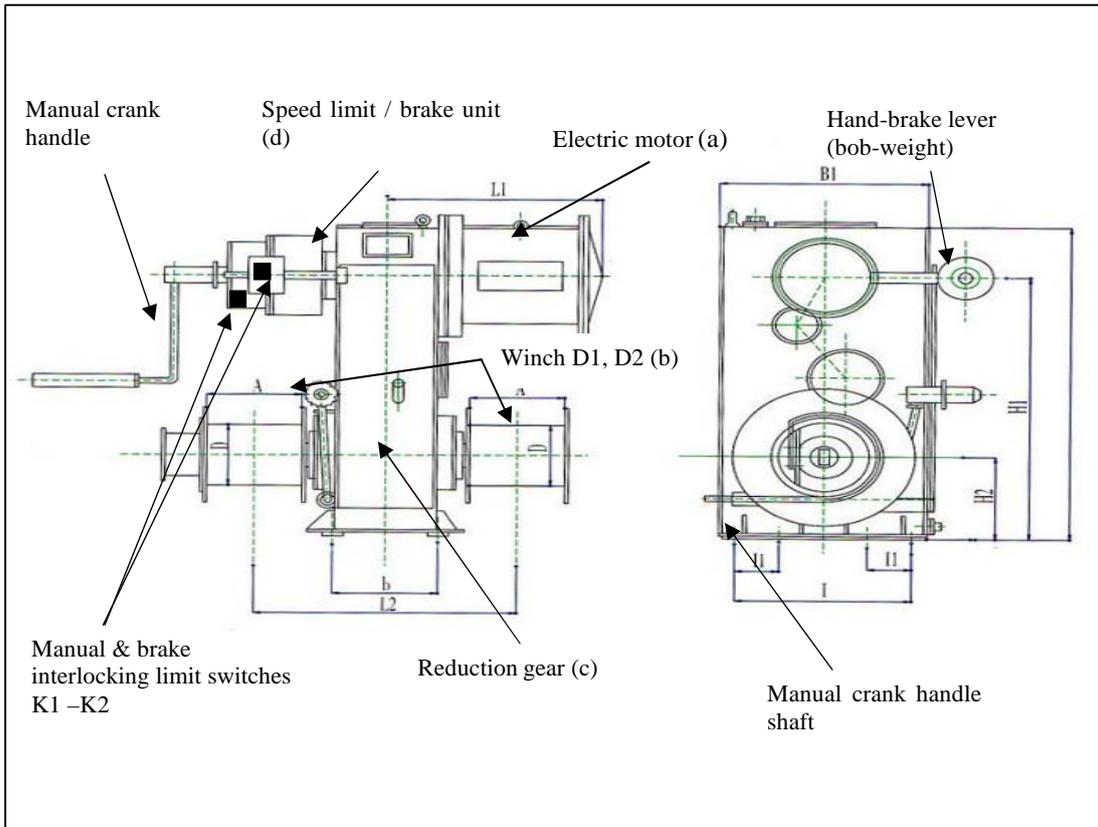


Figure 2: Starboard lifeboat winch assembly

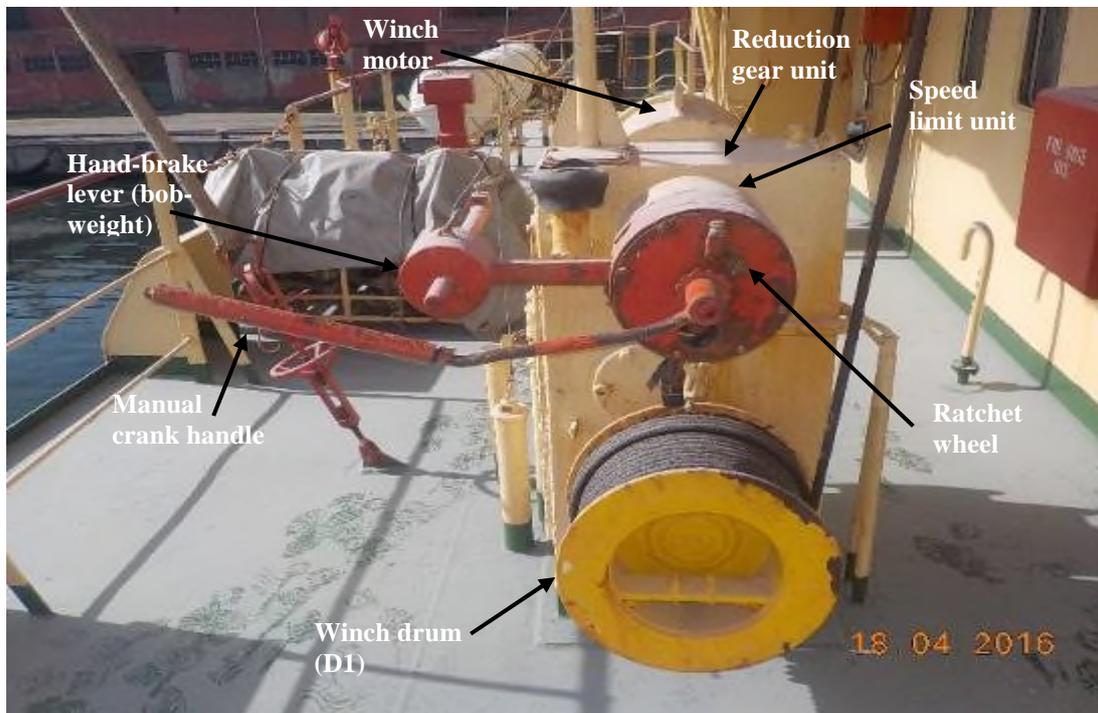


Figure 3: Winch controls

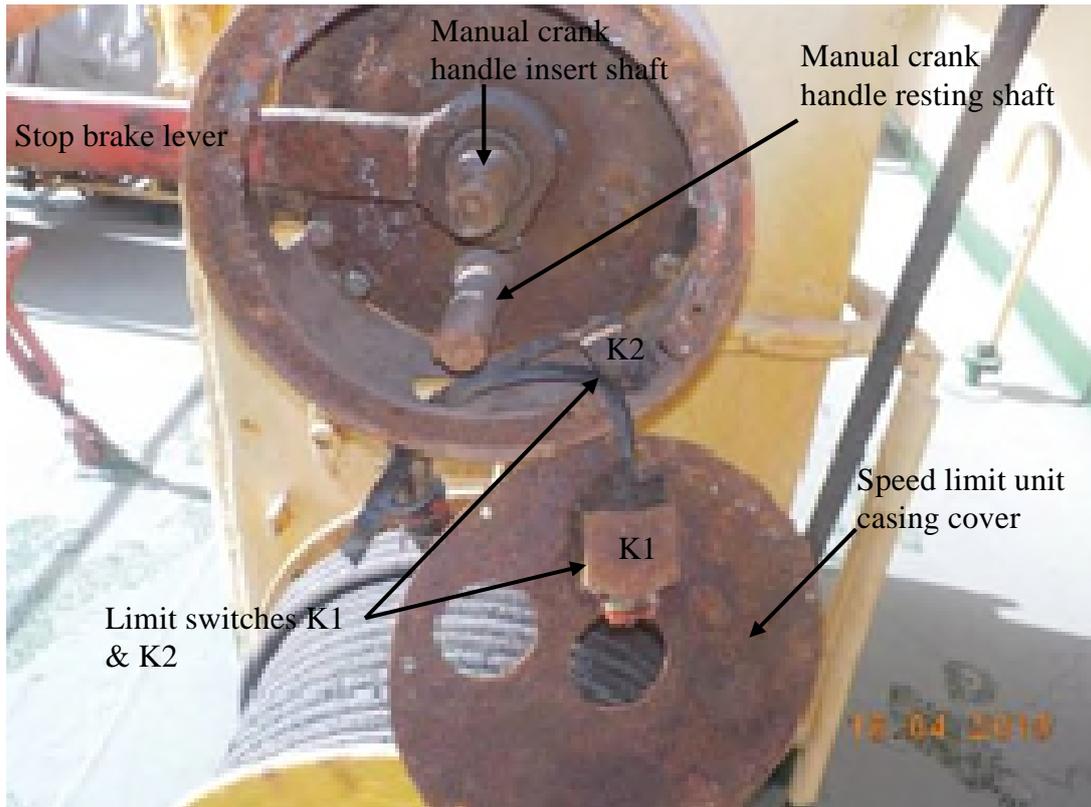


Figure 4: View of speed limit unit with face cover removed

3.6 Lifeboat launch and recovery operation

2.6.1 Lifeboat launching is independent of external power supply and is achieved by the release of the winch stop brake (lift-up of the hand-brake lever (bob-weight)). The release of the stop brake can be operated, depending on the operational circumstances, either locally by manual lifting of the hand-brake lever (clockwise turn) or remotely from inside the lifeboat by drawing a remote handle, hung in the boat, attached through wire rope and a series of pulleys to the hand brake lever⁶ (see figure 3).

3.6.2 After the release of the stop brake, the drum of the winch will begin to rotate anti-clockwise lowering the boat by the weight of the boat alone, so that the davit arms together with the boat turn out from inboard the vessel (while the floating block separates automatically from the arm head tackle). The lifeboat continues to descend in a controlled manner (with a designed speed of 100 m/min controlled by centrifugal braking⁷) as long as the hand-brake lever is kept lifted by the operator. If the lever is let to return to its initial position (lowered) by the operator during the boat lowering (either

⁶ Drawing of this handle, by an operator from inside the boat results in the release of the stop break in the same manner as it is performed locally from the winch station (i.e. clockwise turn of the hand-brake lever).

⁷ The centrifugal type brake shoes push against the drum under the effect of centrifugal forces and automatically limit the lowering speed of the winch to about 100 m/min. The centrifugal brake is not designed to stop the lifeboat descent. Its function is limited to controlling the speed of descent.

locally or from inside the lifeboat), the stop brake will be engaged and the descent will stop smoothly⁸.

- 3.6.3 Recovery of the lifeboat is carried out, under normal circumstances, by the electric driven winch. A permanently mounted electric motor on the starboard lifeboat winch drives the wire drum (D1) for the hoisting and recovery of the lifeboat.
- 3.6.4 A safety interlocking limit switch automatically cuts off the power to the electric motor before the davits arms reach the end of the stowing position. The manual crank handle is used to manually secure the lifeboat and davits into their final stowed position.
- 3.6.5 The starboard lifeboat winch motor is operated through a control station (master controller) installed close to the lifeboat's winch on the boat deck. The master controller controls the hoisting speed by the operation of a two-step speed change lever, selecting a hoisting speed of 18 m/min (step 1) or 36 m/min (step 2).



Figure 5: Master controller with hoist speed selection lever (circled)

- 3.6.6 In the event of a power failure or malfunction of the electrical system, hoisting can also be done manually by using a manual crank-handle inserted into a designated rotating shaft installed concentric to the hand-

⁸ The stop brake is designed to completely stop the lifeboat descent. Its external operating lever is fitted with a heavy weight having the effect of applying the brake by gravity when the hand-brake lever is lowered. Braking forces are generated by friction between the brake drum and the brake shoe lining.

brake lever's pivot (figure 4). The manual crank handle incorporates a ratchet wheel mechanism⁹ to secure rotation in only one direction (counter clockwise). The ratchet wheel is fixed at the end of the handle, while the ratchet pawl is installed upon the end cover of the speed-limit/brake unit. The ratchet wheel mechanism ensures the safety of the operating personnel during the manual hoisting of the boat by preventing the reverse turn of the manual crank handle in the event the hand-brake lever is suddenly raised.

- 3.6.7 During the lifeboat lowering, the manual crank-handle should be removed from the square-end shaft (operating position) and be placed on the side of the gearbox end cover (on a dedicated securing/resting position).

3.7 Winch safety interlocks

- 2.7.1 When the lifeboat is hoisted manually by use of the manual crank-handle, the power supply to the electric motor is automatically cut off, to ensure the safety of the operator, by the intervention of a manual interlocking limit switch (K1).
- 2.7.2 Similarly, when hoisting the hand-brake lever for lowering the lifeboat by gravity, the power supply to the electric motor is automatically cut off by intervention of the brake interlocking limit switch (K2). Limit switches K1 and K2 are installed inside the speed limit unit (within the casing cover and on the inner plate of the unit's housing, respectively (see figure 4)) and are activated by mechanical contact with the manual crank-handle. Both limit switches are of 'normally closed type'¹⁰ disrupting the electrical motor power supply circuit when they are activated.
- 2.7.3 Two additional limit switches are installed on the top of the davit frame to cut off the power to the electric motor during hoisting before the davit arm reaches the end of the stowing position.
- 2.7.4 An additional safety interlock is applied by ratchet-pawl mechanism (see figure 7) when manual hoist of the lifeboat is operated by the manual crank-handle. A ratchet-pawl mechanism prevents reverse turning (lowering) of the crank-handle during the lifeboat hoisting.
- 2.7.5 When hoisting the boat with the stop brake engaged (hand-brake lever in braking position), the electric motor can turn only positively (i.e. turning to hoisting direction) preventing damage to the motor while turning reversely.

⁹ A ratchet wheel / pawl mechanism is based on a wheel that has teeth cut out of it and a pawl that follows as the wheel turns. As the ratchet wheel turns the pawl falls into the 'dip' between the teeth. The ratchet wheel can turn in this respect in only one direction, in the boat hoisting direction during manual cranking of the winch for lifting the lifeboat.

¹⁰ Contact with the operator of the switch moves the actuator to the 'limit' where the electrical contacts change state from closed to open (in the normally closed circuit).

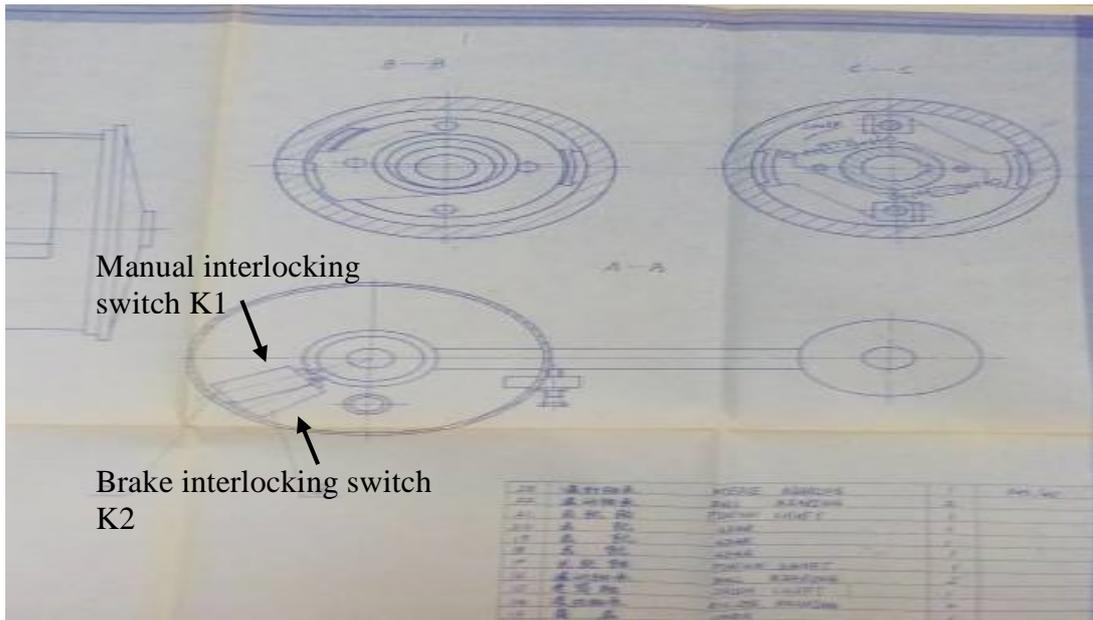


Figure 6: Schematic of the safety-interlocking limit switches K1 & K2

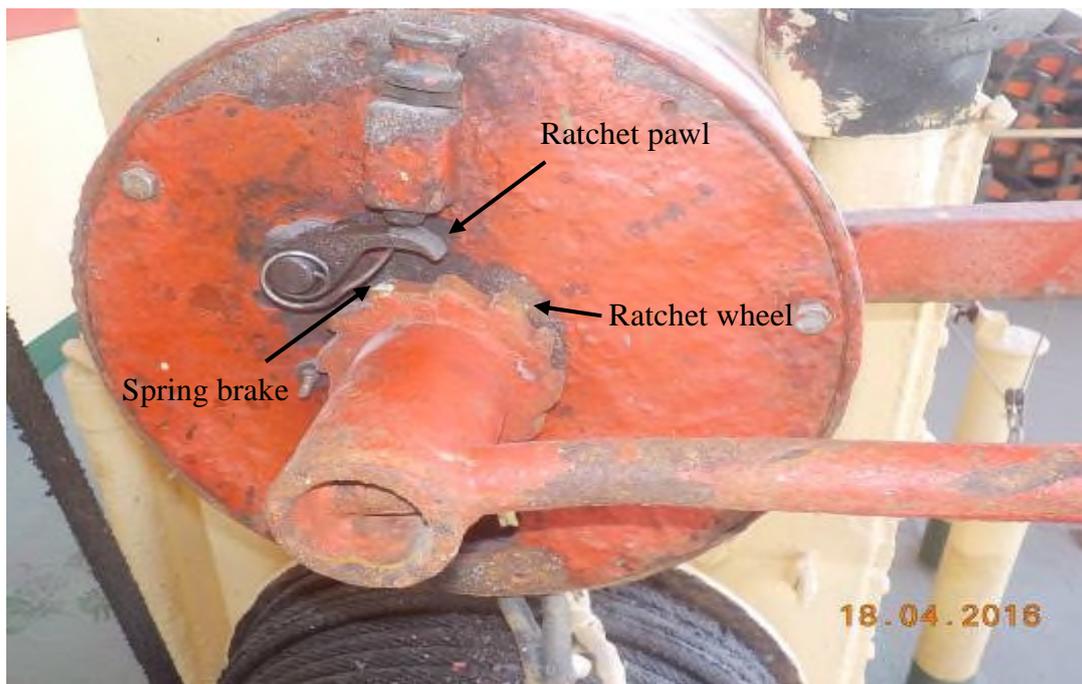


Figure 7: Ratchet pawl mechanism

3.8 Inspection and Maintenance of Lifeboats and Launching Appliances

- 2.8.1 The inspection and maintenance of the lifeboats and launching appliances on board the Amazon is controlled and managed in accordance with the provisions of the planned maintenance schedule described in section six of the Vessel's Operating Procedures document (VOP-S-06)¹¹. Special checklist forms, as required by SOLAS III Regulation 36.1, have been prepared by the Company and are completed and verified weekly, monthly, annually, 5-yearly and at designated intermediate intervals by the vessels crew and management.
- 2.8.2 The weekly and monthly launching appliances maintenance schedule is carried out by the crew, following the VOP-S-06 guidelines for on board maintenance, while thorough examination of the appliances and dynamic testing of the winch brake, as per SOLAS Regulation 20.11.1.1 and MSC.1/Circ.1206¹² requirements, is conducted annually by service providers certified by the manufacturer. The Chief Officer and the 2nd Engineer are responsible, as per the VOP-S-06, for the weekly maintenance/servicing and record keeping, while the Chief Officer, 3rd Engineer and the Bosun are responsible for the monthly maintenance/servicing of the launching appliances, including the function of the winch and the limit switches. The last monthly inspection before the casualty was completed on the 10th March 2016.
- 2.8.3 The latest annual service of port and starboard lifeboats and the associated release gear was carried out on the 23rd February 2016 (7 weeks before the casualty) at Norrköping, Sweden. The vessel's managers engaged TENME¹³ Marine Technical Bureau, who inspected and operationally tested the lifeboats and launching appliances and found them to be in satisfactory condition for use as designed and conforming to SOLAS Chapter III, Regulation 20.11 and MSC.1/Circ.1206 provisions. The servicing company possessed the necessary competence and qualification certificates¹⁴.
- 2.8.4 TENME Marine Technical Bureau service report confirms that the starboard lifeboat and the essential systems and components (mechanical and electrical) of the associated davit and winch had been inspected and operationally tested with satisfactory results. In particular, the winch motor starter, speed change lever (of the winch speed control station), winch limit switches (safety interlocks), manual-crank handle and the stop brake (hand-brake device) were all tested with satisfactory results.

¹¹ VOP-S-6, "Life-Saving & Fire Fighting Equipment: Inspection, Maintenance and Certification"

¹² MSC.1/Circ.1206/Rev.1 – Measures to Prevent Accidents with Lifeboats

¹³ TENME Marine Technical Bureau, ISO 9001 Bureau Veritas Certified

¹⁴ The company is ISO 9001:2008 approved and certified by 7 IACS members to carry out annual and 5-yearly inspections of launching appliances and issue relevant certificates.

3 NARRATIVE OF EVENTS

- 3.1 All times are given in local time (LT), (UTC +2).
- 3.2 At 1100 on 12th April 2016, while the vessel was anchored at Constanta roads anchorage, Romania, the Master decided to conduct a full abandon ship drill in what the Master considered were appropriate weather conditions. The drill included the lowering of both port and starboard lifeboats to the water in order to test the launching and recovery arrangements of the lifeboats and their release and recovery systems. After successful launch and recovery of the port side lifeboat (No.2), which commenced at 1115 and completed at 1130, preparations for launching the starboard side lifeboat (No.1) commenced.
- 3.3 The Chief Officer together with one of vessel's 2nd Officers¹⁵, the 3rd Engineer, one AB and one O/S boarded the lifeboat before lowering to water level. At the same time, the other 2nd Officer together with the Bosun, one AB, Oiler and the Messman remained on the starboard side boat deck in order to operate the winch mechanism for launch and recovery of the lifeboat.
- 3.4 Lowering of No. 1 lifeboat commenced at 1140 and at 1145 the lifeboat was at water level whereupon the on-load release gear mechanism was released rendering the boat waterborne.
- 3.5 At 1150, after completion of tests carried out on the on-load release gear and the associated mechanisms, the floating blocks were secured to the boat release hooks for heaving up lifeboat No. 1 as directed by the Master.
- 3.6 The Bosun then operated the two-step speed change lever of the master controller in order to winch and hoist the boat at slow speed (step1) but the winch motor did not respond.
- 3.7 The Master, 2nd Officer and the Bosun determined that the winch motor was without power supply and in that instant at approximately 1147 the Master ordered the 2nd Officer on deck to go find the vessel's Electrician in order to attempt to restore the power supply to the electric motor of the starboard lifeboat winch.
- 3.8 By 1200, the 2nd Officer had not returned to the boat deck as he was unable to find the Electrician. The Master therefore instructed manual hoisting of the lifeboat to be carried out by the Bosun, with the use of the manual crank-handle.

¹⁵ Vessel's complement includes two (2) 2nd officers on board

- 3.9 The Bosun together with one AB, one O/S and the Messman, who were already on the starboard boat deck, commenced heaving up the lifeboat with the use of the manual crank-handle.
- 3.10 Shortly after (approximately 1203), the Electrician arrived on deck and realized that manual hoisting of the lifeboat No.1 was underway, whereupon he was advised by the Bosun, communicating in their native language (Myanmar), that the electric motor was not turning due to power supply failure, upon which the Electrician proceeded to the air-condition (A/C) room, where the switchboard of the starboard side winch was located, in order to restore the power supply to the motor of the winch.
- 3.11 The Electrician reportedly found the starboard winch switchboard turned off (circuit breakers were down). Upon opening the board's casing, he found a connector (short circuit) between the winch control terminals bypassing the manual interlocking limit switch K1 (which cuts-off the power supply to the winch motor when the manual crank-handle is inserted for hoisting). Another connector (short circuit) was found bypassing the davit arm limit switch (which cuts-off the power to the winch motor when davit arm is fully retracted).
- 3.12 The Electrician determined by several measurements that the cause of the winch power failure was the activation of the brake interlocking limit switch K2, which cuts-off the power supply to the winch motor when the stop brake is released (i.e. when the hand brake lever is raised). In order to neutralize the action of the K2 limit switch, the Electrician installed a further connector in the switchboard bypassing its terminals. Immediately thereafter, at 1205, the Electrician turned on the main switch providing power to the winch controller.

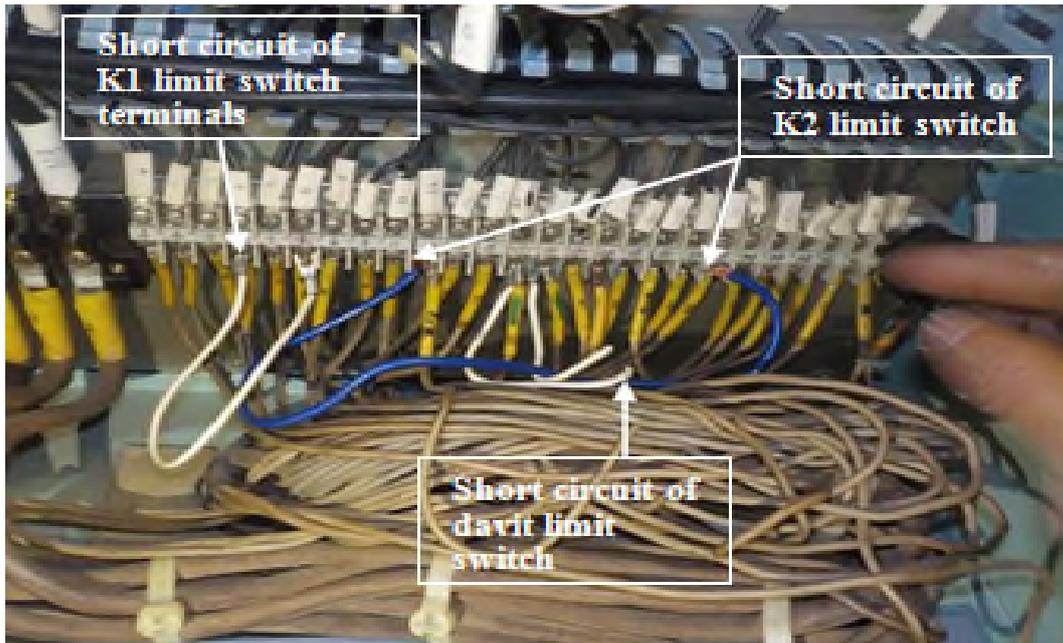


Figure 8: Starboard winch switchboard with pre-existing white cable connectors (short circuit) and the connector fitted by the Electrician (blue cable) bypassing the K2 limit switch to restore power to the winch motor controller.

- 3.13 The electric motor of the starboard lifeboat winch started rotating immediately after the power was restored at the switchboard. The manual crank-handle, which was still installed in the manual cranking position, also started rotating. Due to the location of the Bosun and the Oiler at the time the winch came under power, the crank-handle hit the Bosun on the base of the skull and struck the Oiler on the right side of his hip.
- 3.14 The 2nd Officer, who returned on deck after failing to find the Electrician, found the master control speed selection lever engaged and returned it to the neutral (middle) position moments after the casualty. The handle had stopped rotating on completion of two (2) to three (3) full rotations.
- 3.15 Immediately after the casualty, the Master ordered the Chief Officer and the other 2nd Officer, who until that time were inside the No. 1 lifeboat, to return on deck and assist the injured crewmembers.
- 3.16 First aid was provided by the crew to the Bosun but to no avail, as the head injury sustained by the Bosun was so severe it proved fatal. The Oiler was transferred to his cabin where first aid continued to be provided while the Master contacted the Company's Designated Person Ashore (DPA) and the Constanta Port Authorities and inform them of the situation. The injured Oiler was hospitalized for one day in a local (Constanta, Romania) clinic and was released having been diagnosed with minor bruising to his hip.

4 ANALYSIS AND DISCUSSION

4.1 Procedures

- 4.1.1 The Company's VOP-S-07¹⁶, referring to the emergency organisation and drills necessary to ensure the safety and wellbeing of the crew in case of an emergency, includes specific measures to be taken in order to avoid accidents during lifeboat launch and recovery drills. Specifically, the following provisions are stipulated:

'Abandon ship drills shall be planned, organized and performed so that the recognised risks are minimised and in accordance with relevant shipboard requirements of occupational safety and health, that the hazards related to the drills are taken into account and safeguards & mitigating measures followed. Before conducting drills, it shall be checked that the lifeboat and its safety equipment have been maintained properly, as well as noting all the precautionary measures necessary. Abnormal conditions of wear and tear or corrosion should be reported to Master immediately. It should be ensured that the drill can be carried out in such a way that it is safe in every respect. Consequently, elements of the drill that may involve unnecessary risks need special attention or may be excluded from the drill. Monthly drills with free-fall lifeboats shall be carried out according to the manufacturer's instructions and special guidelines for simulated launching of free-fall lifeboats, so that the persons who are to enter the boat in an emergency are trained to embark the boat, to take their seats in a correct way and to use the safety belts and also are instructed on how to act during launching into the sea.'

- 4.1.2 Moreover, a list of typical risks to be taken into account by the crew during the operation of a lifeboat drill is included in VOP-S-07, highlighting among other risks, inadequate supervision, lack of personnel training as well as poor communication during the drill, incorrect lifeboat handling, broken/faulty limit switches and seized controls.
- 4.1.3 Several typical 'safeguards' relating to the lowering of the lifeboat are identified in the VOP-S-07 document, however there is no such safeguards in place for the recovery (hoisting) operation of the lifeboat. Reference is made under the title '*Specific measures to avoid accidents during lifeboat drills and launching*' which states '*the recovery operation shall be carried out with special attention, bearing in mind the high risk level of this operation*'. Stated within VOP-S-07, it is recommended before conducting drills, it shall be checked that the lifeboat and its safety equipment have been maintained properly, as well as noting all the precautionary measures

¹⁶ VOP-S-07, "The Emergency Organisation-Drills" effective date 15/02/2015.

necessary. Abnormal conditions of wear and tear or corrosion should be reported to the Master immediately. Within the vessels operating procedures, abnormal conditions are not readily defined. Conditions of ‘wear and tear or corrosion’ could be seen to imply that general degradation of equipment is expected and identifying non-conformities in safety appliances are not to be expected.

- 4.1.4 It is mandated within VOP-S-07 that before any boat is launched with crew aboard, it must be tested and launched without anyone aboard, to confirm all safety aspects are in order and to ascertain the arrangement functions correctly. On this occasion, the crew did not abide by this policy and instead conducted the abandon ship drill with personnel embarked in the lifeboat.

4.2 Electrical Circuit

- 4.2.1 It was determined during the course of the investigation that a number of electrical and mechanical safety interlocks on the starboard davit winch system had been intentionally compromised in contravention to SOLAS Chapter III Regulation 20.2¹⁷ and procedures established under section 8 of the ISM Code.
- 4.2.2 In particular, the starboard winch circuitry in the switchboard located in the A/C Room was found non-conforming to the electrical circuit drawings by way of the installation application of direct connectors (short-circuits) fitted to the terminals of limit switches cutting-off the power supply to the winch motor. The short-circuits deactivated the limit switch safety interlocks designed to prevent the winch from rotating when electrical power is applied.

¹⁷ Regulation 20 – Operational readiness, maintenance and inspections

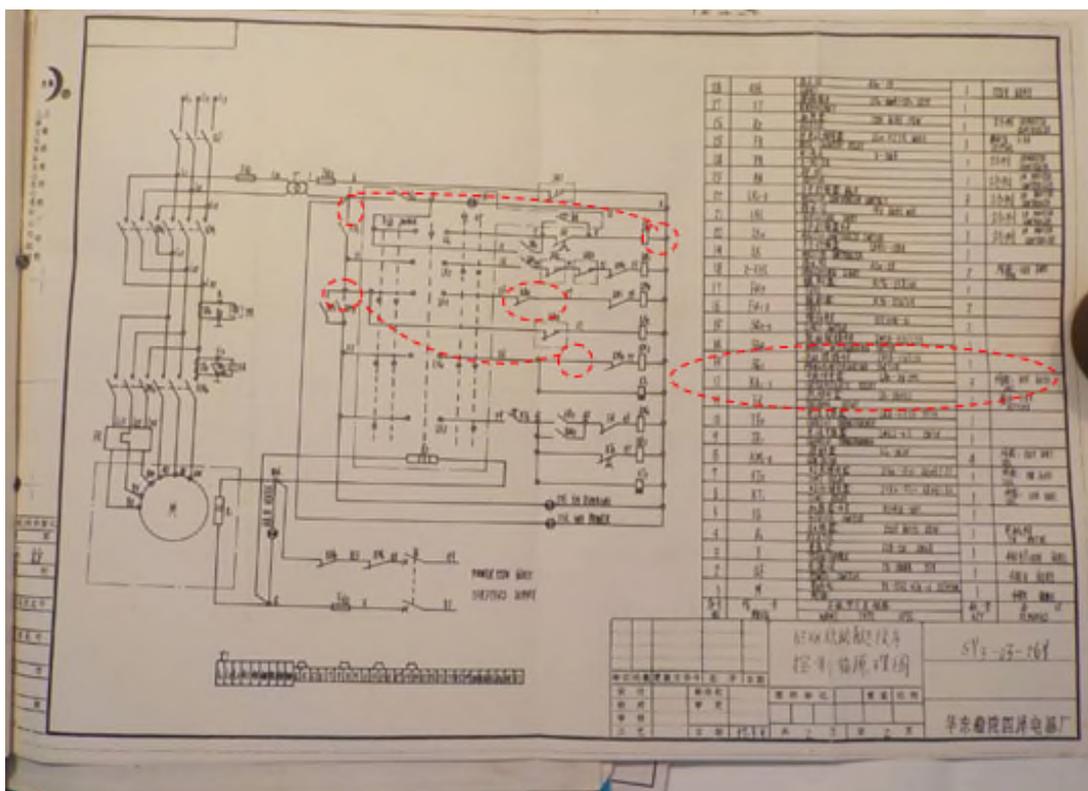


Figure 9: View of the electrical diagram indicating short-circuit contacts on the starboard winch motor power supply

- 4.2.3 According to the vessel’s Electrician, the bypassing of the safety interlocks took place prior to the annual lifeboat inspection on the 23rd February 2016 carried out by TENME. The investigation was not able to determine the exact time the bypass was applied or who had applied the bypass in the switchboard affecting the limit switches.
- 4.2.4 The manufacturer certified service report, provided by TENME, concludes that the port and starboard davits were inspected, operationally tested and found to conform to SOLAS Chapter III, Regulation 20.11 and MSC Circ.1206.
- “The davits were found to be in satisfactory condition for use as designed”.*
- 4.2.5 Notwithstanding the above, the use of wiring with permanent, spade type, terminal connectors implies that this was not a work around solution implemented for one-use only (i.e. for a single launch/recovery operation). It could be considered with a high degree of probability that the bypass was intended as an ad-hoc remedy to overcome inoperable or malfunctioning (mechanical or electrical) limit switches allowing the winch motor to operate.
- 4.2.6 The process of reinstating the power supply to the winch motor occurred simultaneously to the manual hoist being conducted by the Bosun and the Oiler. As the Electrician investigated the power failure at the breaker, it was soon determined that another bypass would be required in order to

restore power to the winch motor. The bypass removed the safety function of K2 limit switch, compromising the safety interlock, as the bypass action eliminated the very safeguard designed to prevent such an incident.

- 4.2.7 According to the International Life-Saving Appliance (LSA) Code, Chapter VI para.6.1.2.6¹⁸, *‘hand-gear handles or wheels shall not be rotated by moving parts of the winch when the survival craft or rescue boat is being lowered or when it is being hoisted by power’*. This requirement was met in the design of the vessel’s lifeboat winches by the presence of both K1 and K2 manual safety interlocking limit switches. However K1 manual interlocking limit switch was already bypassed rendering it inoperable. Once the K2 bypass was applied, all preventative safety appliances were rendered compromised beyond the design function, resulting in power being applied to the winch.

4.3 Mechanical Components

- 4.3.1 Prior to the decision to recover the lifeboat by manual means, the speed change lever was selected with the intention of recovering the lifeboat slowly whilst under power. It is not stipulated within VOP-S-07 what position the speed change lever is required to be in when recovering the lifeboat in either mode (under-power or manual hoist). It was recognized during the course of the investigation that the 2nd Officer had left the boat deck under the direction of the Master in order to find the Electrician so the electrical fault could be investigated and power restored. As a result of the 2nd Officer leaving the boat deck, a lack of supervision over the conduct of the drill existed. The speed change lever remained engaged in the slow position while the Bosun and the Oiler continued to operate the manual crank-handle. It was determined during the investigation that had the speed change lever been left in the neutral position, when power was restored to the winch motor, the winch would not have rotated.
- 4.3.2 Apart from the electrical safety interlocks (limit switches), neutralization of the mechanical safety mechanism installed on the manual crank-handle ratchet wheel¹⁹, to avoid reverse rotation of the handle during hoisting, was also identified. The compromise of this mechanical safety interlock²⁰ is not considered a contributory factor to the accident but is indicative of the lack of safety culture and the unsafe practices followed.
- 4.3.3 Subsequent to the casualty, an inspection of the vessel’s starboard lifeboat winch was conducted on the 19th April 2016 in Constanta by local service provider²¹ who verified that the manual interlocking limit switch K1 was inoperable and in a poor state of repair. The brake interlocking limit switch

¹⁸ Launching and Embarkation Equipment for launching appliances using falls and a winch.

¹⁹ The spring brake applied on the pawl pin was disengaged.

²⁰ The handle can rotate uninterruptedly without the pawl pin engaged

²¹ Company Cobalt Blue, no manufacturer certification held

K2 was found dismantled from the designated position in the speed limit unit, rendering the limit switch out of order. Although the mechanical part of the limit switch was still functional, the electrical connection to the motor's power supply network was absent. The inspection further confirmed that the manual crank-handle had its mechanical safety interlock (racket-pawl mechanism) compromised in way of the safety pawl (pin) spring brake which is designed to prevent reverse rotation of the handle during hoisting.

4.4 Maintenance Procedures

- 4.4.1 The vessel's maintenance records indicate that the winch was last functionally tested prior to the accident on the 23rd February 2016, during the annual inspection of the lifeboats and the launching appliances by manufacturer certified service provider. According to SOLAS Chapter III Regulation 20, as amended, launching appliances (including on-load release gear) have to undergo a thorough examination during the annual survey required by SOLAS Regulation I/7 or I/8 as applicable.
- 4.4.2 Regarding the periodic service and maintenance of the lifeboats and their launching appliances, compliance with procedures established in the IMO guidelines, the ISM Code and SOLAS regulations is required. Section 10 of the ISM Code requires every Company to establish procedures so that inspections are held at appropriate intervals, non-conformities to be reported with their possible cause (if known) and appropriate corrective action is taken in this regard. Personnel undertaking inspections, maintenance and adjustment of lifeboats, launching appliances and associated equipment are fully trained and familiar with these duties in accordance with the ISM Code section 6.
- 4.4.3 The annual inspection, carried out by TENME, and the Class annual survey did not find any non-conformities on the starboard lifeboat launching appliance. Moreover, the monthly inspections carried out by the crew, in accordance with the periodic maintenance schedule; did not identify inoperable or dysfunctional limit switches on the starboard lifeboat winch.
- 4.4.4 Moreover, monthly inspection and maintenance are mandatory requirements of SOLAS Convention (Chapter III regulations 20.7 and 36), the flag State administration and the manufacturer. As defined in MSC.1/Circ.1205, the maintenance procedures that the winch installation should be subject to, to ensure reliability is not less than twice a month. It is also noted that the vessel's periodic maintenance schedule explicitly requires monthly inspections of the davit limit switches, but does not have explicit reference to the inspection and testing of the winch limit switches.

- 4.4.5 The worn-out condition in which the limit switches K1 and K2 were found, and the application of hardwiring (in the switchboard) to bypass their design function, is an indication of a temporary solution established to override the operation of the safety features of the system. No replacement parts were ordered to replace the existing faulty limit switches; the electrical bypass of the limit switches was a solution that alleviated the problem caused by their occasional malfunction.

4.5 Command and Control

- 4.5.1 The abandon ship drill on the 12th April 2016 was not preceded by an operational risk assessment. The task-based specific hazards that had to be assessed by the crew with respect to the lowering and recovery operations, with the winch under power but also using the manual crank-handle, was not conducted and therefore in contravention of the vessel's Safety Management Procedures incorporated within VOP-S-07. This omission prevented the prevailing hazards from being properly identified, including the inoperable safety interlocks (limit switches) of the lifeboat davit winch.
- 4.5.2 The Master was reportedly coordinating the operation from the bridge wing while the Chief Officer and the 2nd Officer were inside the starboard lifeboat. The other 2nd Officer, Bosun and three crewmembers, one AB, the Oiler and the Messman, were on the boat deck carrying out the recovery of the lifeboat. The Master changed his initial order for recovery from powered to manually operated using the crank-handle, but this decision was not adequately communicated to the crew participating in the drill, particularly to the Electrician who was in the process of restoring the power supply to the winch having discussed the matter with the Bosun beforehand. At no point did the 2nd Officer discuss the winch motor failure or rectification process with the Electrician.
- 4.5.3 The investigation determined that none of the crew involved with the drill fully understood how the safety interlocks (limit switches) of the winch worked. This could be attributed to the presentation of information used in the manufacturers' instruction manual and on notices inside the lifeboat, which despite being in English were clearly not very well understood by the crew. Further, there were no markings/special notices or instructions in the vicinity of the launching appliances (winch, davit and the master controller) illustrating the purpose of the various controls and the procedures for operating the appliance (lowering and hoisting, both under power and manual handling). More importantly, posting of warning notices at the winch and master controller starter boxes drawing attention to the various hazards that may occur during the lifeboat lowering/recovery operations were not present.



Figure 10: Winch motor and manual crank-handle devoid of warning notices, operating procedures and hazard identification

- 4.5.4 The working language on board the vessel is English, as per the Company SMS. However, during the course of the investigation, the language used between crewmembers of the same nationality was generally their native speaking language, but when communicating with the rest of the crew, being of different nationality, the English language was used. From the crewmembers involved in the drill, the Officers were of Ukrainian nationality and the ratings, including the Bosun and the Electrician, were from Republic of the Union of Myanmar. The final communication between the Bosun and the Electrician was spoken in their native language. It cannot be determined how significant the conversation between the Electrician and the Bosun was, however, had the conversation taken place in the working language of the vessel, any misunderstanding in the safe operation of the winch or the intentions of the Electrician may have been heard by another crewmember, which may have led to identifying any misunderstanding with the operation of winch.

5

CONCLUSIONS

- 5.5.1 A fatal injury was sustained by the Bosun on the 12th April 2016 during the execution of a routine abandon ship drill. During recovery of the lifeboat the winch motor failed to operate, the decision was made by the Master to recover the lifeboat manually using the crank-handle. During the process of recovery, the winch motor became energised and rotated, resulting in the engaged crank handle striking the Bosun on the head and the Oiler in the region of his hip.
- 5.5.2 The Amazon's Master and crew were well versed in launching and recovery of lifeboats, conducting monthly drills in accordance with ISM procedures and demonstrating an abandon ship drill on the port lifeboat that morning without incident.
- 5.5.3 Adequate supervision of the boat deck was not maintained throughout the course of the drill. In the absence of the 2nd Officer from the master controller, the drill was not adequately coordinated or controlled leaving the crew unnecessarily exposed to events outside the control or coordination of an Officer. At the operational level the 2nd Officer is required to organize the drills and be knowledgeable in the operation of launching appliances and arrangements. The point when the Master asked the 2nd Officer to leave the boat deck to find the Electrician without specifically suspending the manual recovery process can be considered a critical contributory factor; particularly as special attention was diverted from the drill during what is defined as a high-risk operation.
- 5.5.4 The three safety interlocks designed into the system to prevent damage to the operator or the equipment during the recovery of the lifeboat were found to be mechanically and electrically compromised. Critically, the application of ad-hoc electrical bypass of the limit switches (K1, K2) in the switchboard meant K1 limit switch was no longer able to isolate power to the winch motor despite the crank-handle being in situ. Verification of periodic maintenance was being conducted in accordance with the vessel's safety management system however the vessel's periodic maintenance schedule does not provide instructions for the inspection and testing of the winch limit switches. Verification of the operability of limit switches on the starboard lifeboat assembly was not conducted resulting in the unknown condition of this critical safety appliance.
- 5.5.5 If manual interlocking limit switch K1 was operating as designed, when the crank-handle is in situ, the winch cannot rotate due the isolation of electrical power supplied to the motor. The only safeguard stopping the rotation of the crank-handle once inserted, should K1 be bypassed, is the selection of the neutral position of the two-speed change lever. If this speed change lever is in either slow or fast mode, the winch motor will rotate

accordingly. There are no warning signs or instructions informing the operator of the master controller to ensure the speed change lever remains in the neutral position when not in use.

- 5.5.6 It is evident, as demonstrated with the successful launch and recovery of the port lifeboat, that the crew were capable of conducting a safe abandon ship drill. Despite the vessel conducting mandatory drills, familiarity of alternative recovery modes was not routinely exercised. It is known that not all members of the crew involved in the abandon ship drill fully understood the procedures, particularly the reversionary modes or safety features designed to minimise risk. Had a safety brief taken place prior to conducting the drill, specific identifiable hazards could have been explained.

6

RECOMMENDATIONS

Recommendations for the Operator:

- 6.1 The operator should consider a review of the Safety Management System with respect to winch assembly and davits to ensure inspection and verification procedure sufficiently identifies faults with the winch assembly and interlocking limit switches.
- 6.2 The operator should ensure that safe operating procedures and potential hazards are displayed prominently in vicinity of the master controller and winch assembly unit to highlight safe and proper operation of the appliance.
- 6.3 The operator is to ensure the vessel operating procedure (VOP-S-07) is reviewed to incorporate specific guidance and instruction, including identifying associated typical hazards and safeguards relating to the recovery of both lifeboats.
- 6.4 The operator should consider reviewing the process of instructing the crew on relevant safety matters prior to conducting any drill.

The Owners have acknowledged all of the recommendations, agreeing to implement in their entirety. The proposed actions provided by the Owners will be verified by the Bahamas Maritime Authority within six months of the date of this report.

7

LIST OF APPENDICES

- I. Additional photographs
- II. Inspection report of lifeboats and davits (dated 23rd February 2016)
- III. Inspection report of the winch of the starboard lifeboat davit (dated 19th April 2016)

Appendix I: Additional photographs



Figure 11: Starboard side boat deck in way of lifeboat No.1 davit from aft

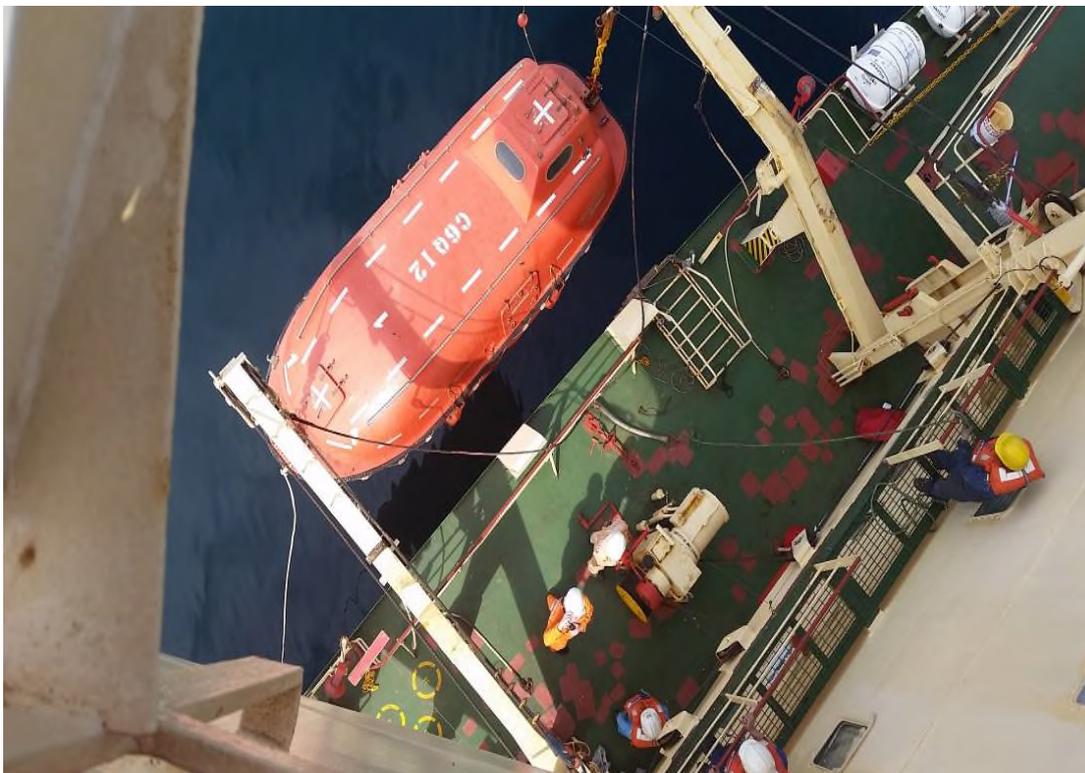


Figure 12: Starboard side boat deck during lowering of lifeboat No.1, taken from bridge wing



Figure 13: Winch assembly unit and manual crank-handle



Figure 14: Manual crank-handle insert shaft



Figure 15: Master controller with two step speed change lever

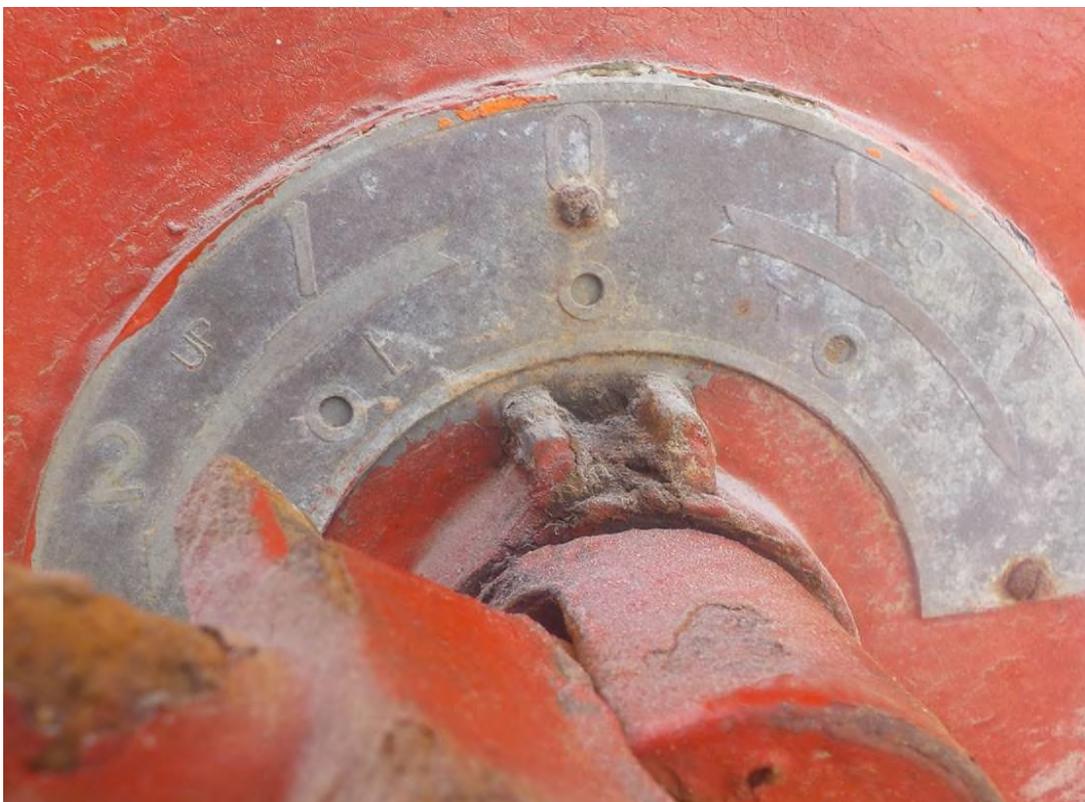


Figure 16: Speed change lever speed control and neutral location



Figure 17: View of bypass connections within switchboard