THE COMMONWEALTH OF THE BAHAMAS

NOVA BRETAGNE

IMO Number 9000364
Official Number 71628376

Report of the investigation into the Accidental release of lifeboat during a drill

at
Antonina, Brazil

on

14th November 2009

The Bahamas Maritime Authority investigates incidents at sea for the sole purpose of discovering any lessons which may be learned with a view to preventing any repetition. It is not the purpose of the investigation to establish liability or to apportion blame, except in so far as emerges as part of the process of investigating that incident.

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 a person cannot be required to give evidence against himself. The Bahamas Maritime Authority makes this report available to any interested parties on the strict understanding that it will not be used as evidence in any court proceedings anywhere in the world.

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1 SUMMARY

1.1 The NOVA BRETANGE was carrying out a routine lifeboat launching drill while the vessel was alongside in Antonina in Brazil on 14th November 2009. The port (No.2) boat was exercised and re-stowed first, followed by the starboard (No. 1) boat.

1.2 The No.1 boat was manned. Three crew were on board from the stowed position, throughout the lowering to the water and during the recovery to the re-stowed position.

1.3 The release mechanisms were tested on both boats during the waterborne sector of the operations.

1.4 In the case of No.2 boat the reconnection to falls was uneventful. But the crew experienced difficulties in preparing the No.1 boat for recovery from the water.

1.5 Difficulties were experienced with re-setting of the hooks to the locked position but with the assistance of the Bosun they were, after a number of trial resetting operations, secured in a state that was believed to be safe for hoisting.

1.6 The lifeboat had been hoisted to the stowed position when the after hook opened unexpectedly. This was followed by a similar opening of the forward hook and the boat fell to the water where it impacted in an inverted attitude.

1.7 The boat righted itself in the water but substantial damage had been inflicted on the upper works of the hull. Minor holing identified as contact with the davit had also occurred to the hull.

1.8 The three seafarers in the boat sustained serious injuries.

1.9 Damage to the boat was substantial and included a detachment of the internally mounted buoyancy tanks from the overhead shell of the boat. The port tank fell down and is believed to be responsible for some of the injuries sustained by the seafarers.

1.10 The seafarers were wearing their seat belts. All three were hospitalised after having been extracted from the boat at the quayside.

1.11 The lifeboat had been subjected to maintenance and checking of a shore, licensed contractor on 27th May 2008. The inspection found the boat and its associated equipment to be in order. The checks listed in the examination report included release gear.

Photo 1: Ship's crew move quickly to recover the damaged boat to the shore after the accident and to rescue the injured boat's crew.

2 PARTICULARS OF VESSEL

2.1 "NOVA BRETAGNE" is a Refrigerated Cargo Ship registered at Nassau, Bahamas. The vessel has the following principal particulars:

- Official Number - 71628376
- IMO Number - 9000364
- Length overall - 120.70 metres
- Breadth - 16.6 metres
- Gross Tonnage - 4482 tonnes
- Net Tonnage - 2222 tonnes
- Call Sign - C6J17

2.2 The vessel is powered by a main diesel engine that developed 4120 kW and which drove single fixed bladed propeller.

2.3 The vessel was built in 1990 by Kyokuyo Zosen, Yamaguchi, Japan

2.4 The vessel was first registered under the Bahamas Flag in 1990 and was entered with the Bureau Veritas classification society. At the time of the accident she complied with the all statutory and international requirements and certification.

2.5 The vessel is owned and managed by Seatrade Groningen BV

2.6 NOVA BRETAGNE was last subjected to a Bahamas Maritime Authority Annual Inspection at the Port of St Petersburg on 24th October 2008, 7 Observations were made.

2.7 The vessel had been subjected to Port State Control Inspections over the previous year at the Ports of St Petersburg on 16th November 2007. There are no outstanding deficiencies from these inspections.

Description of Lifeboat.

2.8 NOVA BRETAGNE is equipped with two davit launched lifeboats, one on the starboard side (No.1) and the other on the port side (No. 2) of the accommodation block in the after part of the vessel.

2.9 The boats are launched from gravity davits of the pivoting type, the fulcrum of the pivot being at a position close to the deck – a typical arrangement for cargo vessels.

2.10 The No. 1 boat was the craft involved in the accident. It is, identical to the No.2 boat with the exception of the positioning of the skates for making contact with the ship's hull during lowering. These are positioned on the port side of the No. 1 boat.

2.11 The Boat is a 6.50m x 2.60m x 1.10m Model No. SZ-65BR totally enclosed lifeboat. The boat is built by Shigi Shipbuilding Co. Ltd of Osaka Japan.

2.12 The No.1 lifeboat is also designated as a rescue boat.

2.13 The release mechanisms of the suspension hooks are described as "On/Off load "SHIGI release gear" "Simultaneous Release Device" Model type SZK-5 manufactured also by Shigi Shipbuilding Co. Ltd.

2.14 The release gear is designed to be operated in an "off-load" mode, but can be operated in an "on-load" mode allowing the hooks to pivot to a position in which they no longer offer support of the boat on the falls to which they are attached by a lifting ring.

2.15 Operation of the release mechanism is performed by the helmsman of the lifeboat using a single lever designed to involve a number of deliberate actions before it can be activated. Unlike a number of other designs there is no hydrostatic interlock operating when the boat is waterborne. The lever is offset to starboard so as to be operated by the helmsman's right hand.

2.16 The detail of the "off-load" and "on-load" functions, as well as the intervention functions are discussed in the analysis section below.

3 NARRATIVE OF EVENTS

3.1 All times noted in this narrative are given in the style of the standard 24 hour clock without additional annotation and as local time in the port of Antonina, which was on the standard time for Brazil - UTC-3. The year to which all references to date relate is 2009.

3.2 The weather at the time of the incident was calm. Weather conditions were benign and the launching conditions could be considered ideal.

3.3 The No.2 boat had been lowered, recovered and re-stowed without incident.

3.4 The vessel was positioned such that the stern was clear of the berth and clear water was available to launch both boats. The Master took the opportunity to exploit this unusual arrangement and chose to exercise both port and starboard boats.

3.5 The Second Officer was in charge of the No.1 boat during the exercise.

3.6 During the waterborne phase the Second Officer experienced difficulty in returning the releasing handle to the stowed position. The precise nature of the difficulty is not known.

3.7 The Bosun and a fitter were detailed to enter the boat and assist the Second Officer whilst it was afloat.

3.8 The Bosun and Second Officer were able to re-set the hook mechanism, repeating the operation 3 or 4 times after which it was deemed safe to reconnect the falls and hoist the boat to its stowed position.

3.9 During the lift from the water the Bosun, now on the hoisting controls on deck suspended the lifting operation when the boat was just above the water before hoisting to the stowed position.

3.10 The Second Officer and two crew remained in the boat during this entire hoist which continued without incident to deck level.

3.11 The boat was almost in the fully stowed position, before which the crew could not disembark, when the after hook unexpectedly released.

3.12 According to the Bosun it was when the boat had begun moving " together with davits to stow position" that the hook opened. From this remark it is assumed the davits were fully home or nearly so.

3.13 The boat had not been equipped with Fall Protector Devices (FPDs). As a consequence each hook was without any further safeguard against falling if it opened.

3.14 With support no longer present at the after end the boat then fell, rotating around the forward hook, which was initially still attached. According to the Bosun, "after 1 – 2 seconds" the forward hook also opened. The boat was then free to fall to the water.

3.15 It is unclear exactly how the attitude taken by the boat changed during its fall to the water as there is limited testimony including such detail. The Master referred to the boat during this phase in his testimony as ".. went self released, lifeboat fell down on boat deck. Turn over and fell down into water upside down".

3.16 The Bosun's statement – "Life boat fell on boat deck, turn over and fell into the water" together with that of the Master, appears to indicate a rapid disconnection sufficient for the boat not to take on an end-on attitude during its fall. The form of both statements is very similar. The Master carried out the translation but the evidence of damage to the boat supports the description and the quality of the statement is not questioned.

3.17 During the fall the boat struck the davit keel support and the deck before turning over and falling to the water. Evidence of the damaged davit and matching hull damage indicates this conclusion as highly likely.

3.18 Evidence of the damaged superstructure of the boat suggests an inverted impact at the water but to what degree is unknown.

3.19 Having impacted in the water the boat effectively righted itself and crew from the ship moved rapidly from a position onshore to bring the damaged craft alongside.

3.20 In the recovery operation after the accident the damaged superstructure was further deliberately damaged in an effort to make a clearer access for the rescue of the injured seafarers.

3.21 The three occupants of the boat, were all seriously injured. They were transported to hospital but were too badly injured to provide first hand testimony at the time.

4 ANALYSIS

4.1 The unplanned release of the lifeboat could have had its origins in a number of factors, namely:

- A design flaw in the release mechanism;
- A manufacturing flaw in the release mechanism;
- A failure of signage to effectively instruct crews in the correct operation of the release mechanism; and/or
- Failure of crewmembers to correctly maintain the release mechanism; and/or
- Failure of the crewmembers to correctly operate the release mechanism.

The mechanism of failure is analysed as follows:

4.2 Close inspection of the lifeboat was carried out after delivery to a specialist lifeboat repairer POLYREP BV [1]of Hellevoetsluis, Netherlands and the condition of the various parts of the boat ascertained.

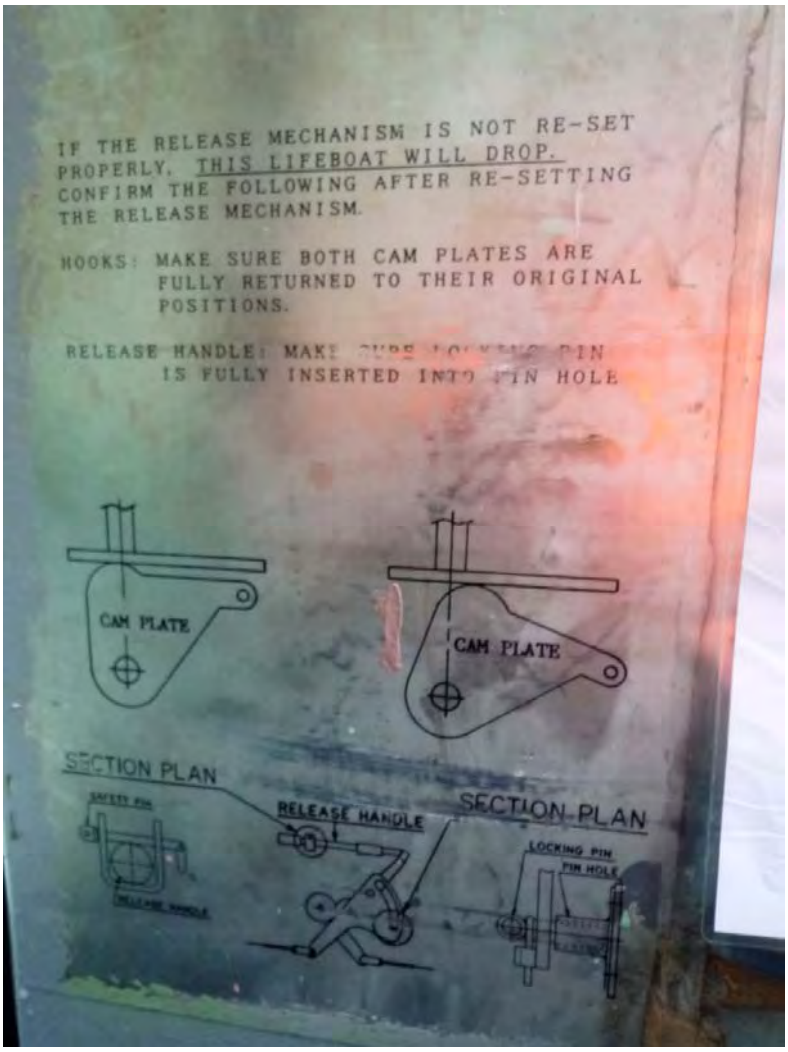
4.3 The after and forward hooks were both seen to be free in their movement as were the associated locking parts including the under-deck part of each mechanism, which includes a visible cam that serves as an indicator. The hooks had been painted, which is unnecessary with their galvanised protection but in this case it was not adversely affecting the operation of the moving parts.

4.4 The under-deck cam of the after hook was not settling in the correct position for the "safe" condition indicated in an instruction plate on the side of the engine housing beneath the helmsman's seating position.

[1] **Polyrep BV**
are approved by LRS, GL, and RINA to carry out inspection of, as well as maintenance and repair to Lifeboats

Photo 2 and 3: Under-deck cam plate.

The under-deck Cam Plate indicating a position in which the release of the hook was possible (not necessarily the position in which the failure occurred but held in this position for clarity of subject area)



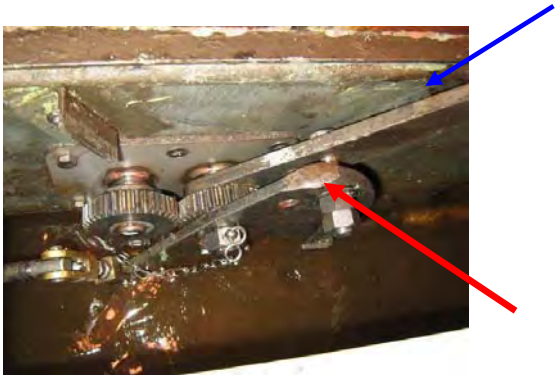
Above:
The instruction plate close to the helmsman's feet, indicating correct and incorrect settings for the under-deck cam plate

4.5 Investigation revealed that the release lever mechanism at the activation point used by the helmsman was damaged although it was still operable. Interlocking teeth of the two meshing gear wheels were damaged. These in turn operate the cranks that are connected through the turnbuckles to the flexible cables operating the under-deck cams.

Photo 4 and 5: Release mechanism activation point.

Gear teeth showing damaged interlocking surfaces; Some but not all signs of damage arrowed.

The assembly as a whole seen from above and slightly outboard to starboard; Evidence of abuse hammering: arrowed red and backplate joint of flattened lever stop: arrowed blue.



4.6 Further damage to the release lever mechanism was also evident. The crank nearest the operator, labelled "gear" in the manufacturer's diagram (Figure 1 below), was damaged, showing signs of being hammered in the past. This would suggest that the system could have been locked up at some time due possibly to misalignment of the damaged gear teeth and excessive force was used to free the mechanism. Impacts from the same force may have been responsible for damage to the gear teeth originally.

4.7 The cause of the damage to the gear teeth has not been determined, there were no records relating to it. The cause of a lock-up as suggested above was not evident during investigation, all movement on the hooks and associated parts, including cables having been found free. This does not however prove that it was always thus. No records were available reporting such malfunction.

4.8 A stop, labelled "handle stopper" in figure 1 (below arrowed in red and highlighted in yellow), designed to prevent the handle being set too far forward during a re-setting operation, was found to be bent almost flat as a result of excessive force being applied to the handle in the re-setting position (the one illustrated). This would result in removal of a defined stop position for the lever. If, as would appear to be a possibility, this was the case and/or the turnbuckles connecting the cables to the two operating cranks were wrongly adjusted, the final position of the under-deck cam - known in manufacturer's drawings as the Cam Plate - would be proportionately affected.

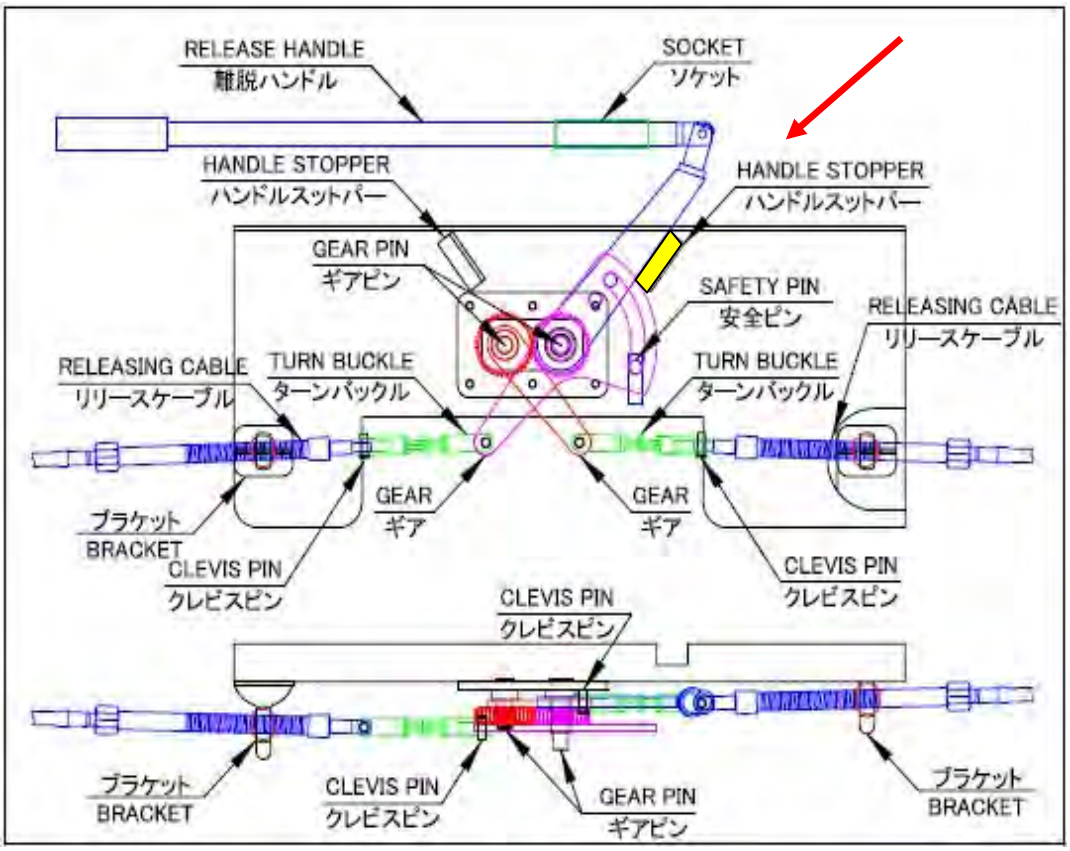


Figure 1: Release handle mechanism. Diagram from SHIGI Manual

4.9 The stop referred to above is not fully visible in Photo 5 but it's joint with the back plate is. It is positioned behind the lever, between it and the back plate in a folded flat state. This means that the lever pictured is not in the correct position – it is too far forward – suggesting that the whole linkage is out of adjustment. This in turn allows for a final position of the Cam Plate intended to lock the hook could be out of the horizontal. (see also 4.5 above and 4.11 below).

4.10 The above analysis shows that it is possible for the final position of the under-deck Cam Plates – forward or aft - to be less than clearly defined. The importance of the horizontal position of the cam, as defined in the instruction plate may have been lost and the instruction diagram (Photo 2) is less than prominent. Since there is no testimony from any of the operatives in this regard it is impossible to determine that this was a contributory reason for the failure but misalignment of the under-deck cam plate remains the most likely cause of initiating a load induced override of the system. There are, however further issues to analyse.

4.11 The turnbuckle connection between the operating levers, both forward and aft, were seen to be very slightly out of adjustment at the repair yard. It cannot be determined precisely if this equated to their position at the time of the accident. Nevertheless, the clevis at the inner (crank) connection allowed movement in the vertical plane as would be necessary in the process of operation. It also allowed for a measure of lateral movement.

4.12 The outer clevis of the turnbuckle, would need to be at right angles to the inner one to prevent a further articulation in the vertical plane at the connection with the cable end. The angle found was less than a right angle and the locking nut was not effective in maintaining the orientation of the outer clevis in the correct plane with the pin vertical. The play in the inner clevis pins (both forward and aft) allowed a displacement of the outer clevis in the lateral plane.

4.13 The lateral displacement of the outer clevis was able to translate into a rotation about the longitudinal axis formed at the ball jointed cable clamp as the release lever was moved to the re-set position, pushing the cable connection through the same arc as it did so. (See photo 6 below) This rotation would allow a second articulation at the outer clevis in the vertical plane as the clevis itself rotated under the influence of the torque being translated from the movement. The cable, as a result would remain in the same longitudinal position (A) instead of the correct position (B). The under-deck Cam Plate would thus remain in the release position or a position between it and the re-set position as in Photo 7 below, despite the operating lever being in the closed, i.e. re-set position. The sequence is described in greater detail below.

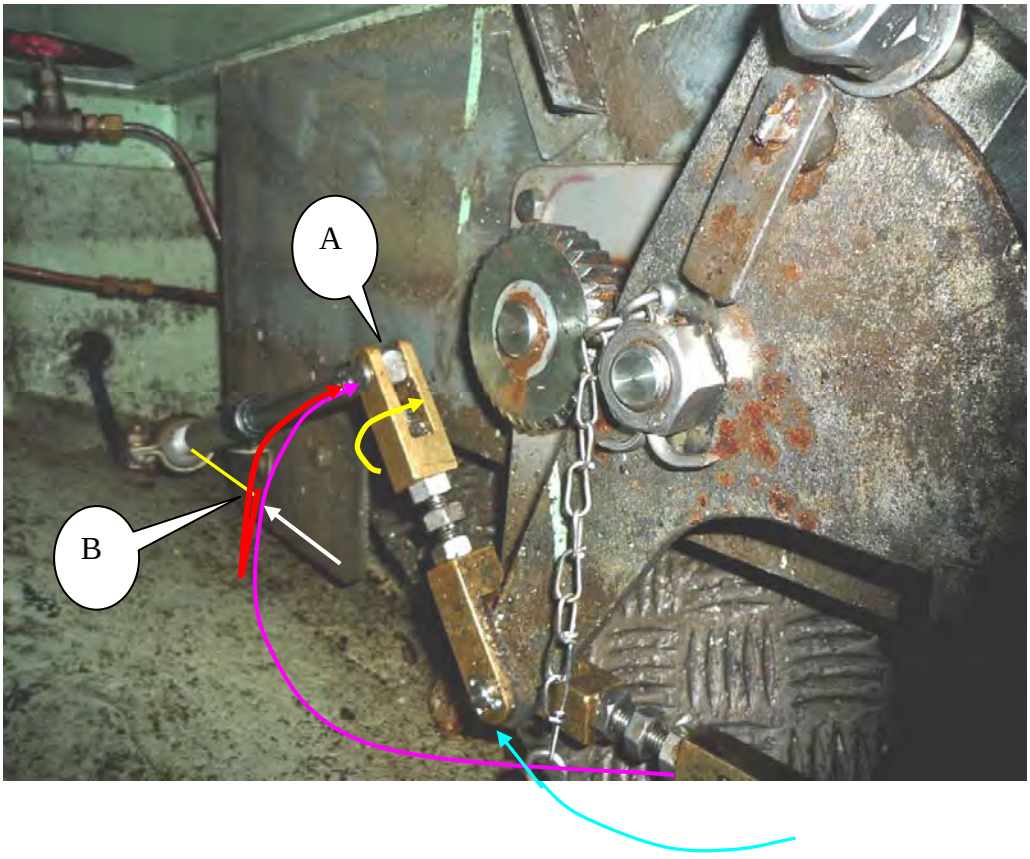


Photo 6: Release handle mechanism displaced from correct re-set position as found possible at repair yard. Note orientation of outer clevis (upper centre of picture).

4.14 Displacement of the after outer clevis is possible as in Photo 6 through the conical path shown in magenta. Because the locking nut on the turnbuckle is inadequate to resist the resulting torsional forces the rotation indicated by the yellow arrow in Photo 6 is possible. The Release Lever, in being pushed forward to the re-set position causes the crank to which it is attached to describe the arc shown in turquoise (light blue) in the vertical longitudinal plane. The crank arc is constrained to the longitudinal plane by its rotation about the pinion of the Gear Pin (see Figure 1), which is fixed in the athwartships or lateral plane. The cable end to which the outer clevis is attached however is free to rotate over a limited field of movement by the ball joint bracket by which it is constrained (left of picture in distance of Photo 6). The correct path for the cable/clevis joint is shown by the yellow line and white arrow.

4.15 The above displacement is described from the viewpoint of being induced during re-setting but reversed forces could produce the same result after the lever had supposedly been re-set. In the event that forces on the cable from the hook end were possible and if the locking nut of the turnbuckle is unable to prevent rotation of the outer clevis about the longitudinal axis the cable end can describe the arc shown by the red line in Photo 6 with the Release Lever static in the re-set position. The mechanism of the malfunction is the same. The only difference is the direction of the pushing force at what becomes the second articulation of the linkages.

4.16 The ball joint constraining the cable is contributory in the above malfunction. Its position is offset to starboard whilst the hook assembly at its far end is on the centreline. This creates a tendency to realign more directly with the route to the after hook displacing the outer end of the cable in an outboard direction that is misaligned with the correct longitudinal alignment.

4.17 In the event of resistance of movement of the under-deck cam plate, the conical displacement shown by the magenta line in Photo 6 is possible as soon as the clevis rotates under the asymmetric rotational forces acting upon it in the event of a resetting movement. The additional articulation of the linkage caused thus will result in little or no movement of the under-deck cam plate at the far end, i.e. the after or forward hook, all of the displacement having been taken by the articulation of the outer clevis. This in turn leaves the hook susceptible to opening as the tail of the hook is not fully secured in the correct closed position.

4.18 The under-deck Cam Plate, position in the above abnormal circumstance would be similar to Photo 7 below.

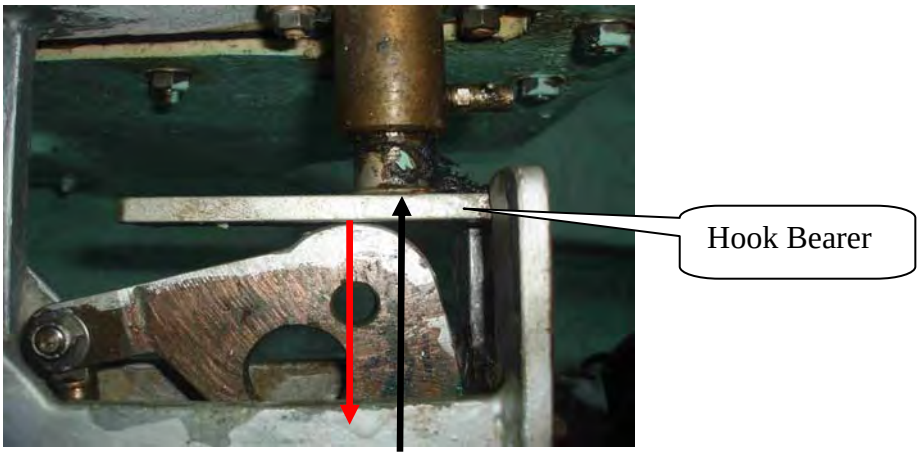


Photo 7: Under-deck Cam Plate in incorrectly re-set position.

In this position the tangential contact of the Cam Plate with the Hook Bearer will not be aligned vertically above the fulcrum point and the combination of the down thrust due to the pressure from the hook (red arrow) and the upward reaction through the Cam Plate fulcrum (black arrow) will result in an opening couple. See also Figure 2.

4.19 In order for the under-deck Cam Plate to rotate downwards, thus releasing the Lock Piece via the Hook Bearer the linkages of the operating cables must have been displaced, either by deliberate action or under load through the Lock Piece ⑦, Hook Bearer ③ and Cam Plate ④ (See Figure 2).

4.20 As described earlier, the potential for a second articulation of the linkage at the operating lever was dependent on the correct horizontal alignment of the clevis on the outboard end of the turnbuckle joining the cable to the operating lever. This is equally true for the forward as well as the after hook but in the repair yard the forward hook was seen to be in the correct, locked position.

4.21 It is noted that there are some minor differences between the hook fitted to the boat (Photo 8) and the one depicted in the manufacturer's drawing (Figure 2). The side plates do not have the extended horn with hanging-off points formed by the shackling hole - Figure 2 - **(30).** They are however provided with lugs on either side (starboard lug visible in photo). These lugs have significance in the use of FPDs discussed below.

4.22 The Cam Plate ④ depicted in the drawings does not include the hole at the centre of curvature of the bearing surface interfacing with the Hook Bearer ③. In the subject boat this hole existed and can be seen in the photographs. It could be significant if a pin type FPD were introduced to the design (see Recommendations)

Photo 8: Hook as fitted. Note lug on side of side plate. There is another on the opposite side.

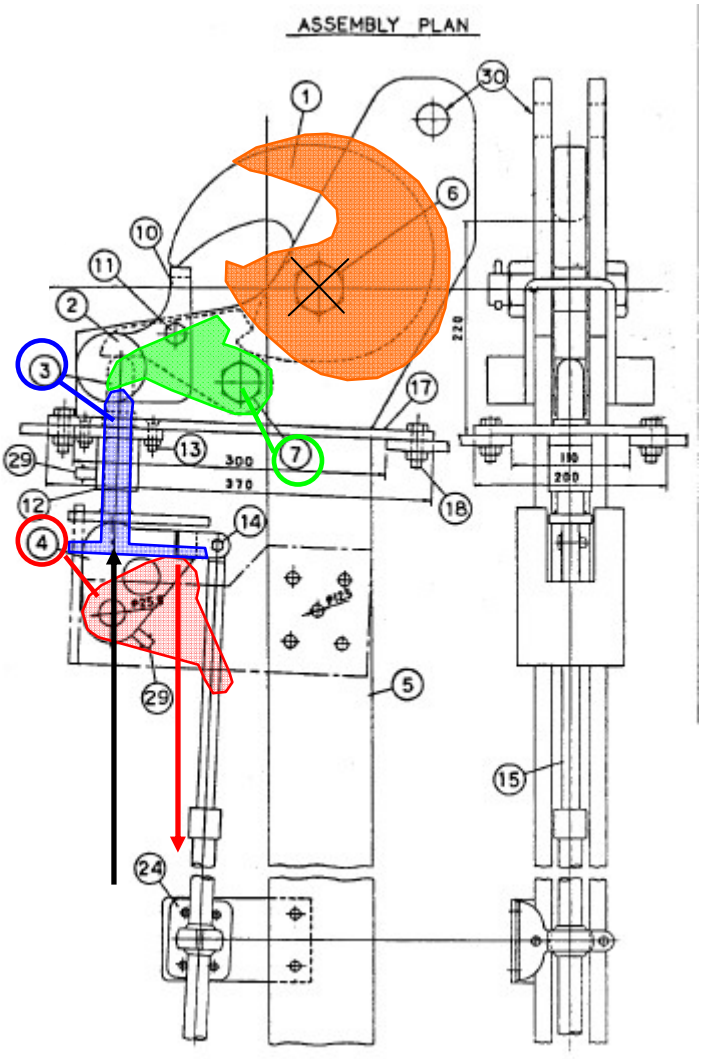


Figure 2:
Hook Assembly showing mode of operation. Note in closed position Cam Plate ④is tangentially in contact with Hook Bearer ③ in position vertically above fulcrum of Cam Plate thus locking mechanism. In any other position an opening couple is possible under load, indicated by Red arrow, representing downward force acting in conjunction with the black arrow representing the lifting force exerted by the suspension link acting through from the hook ①

Drawing: Developed from Excerpt from manufacturer's drawing B73-015

4.23 If the cam plates were not in the locked position the weight of the boat – 4500 kg plus gear and occupants – would apply an opening couple through the Lock Piece – Fig.2 ⑦, Hook Bearer – Fig.2 ③ and Cam Plate – Fig.2 ④, illustrated by the red arrow in conjunction with the black arrow in Figure 2. The resulting force could displace the cable if the second articulation occurred at the Release Lever position.

4.24 At the repair yard the resistance to movement within the cable and associated mechanism was minimal and could be achieved by applying relatively low manual forces to the outer clevis articulation to straighten its path. It is therefore considered possible that the mass of the boat would be more than enough to cause the reverse displacement despite the multiple levers involved.

4.25 The centre of gravity of the boat would be biased towards the after end because of the position of the engine. The force component of the opening couple referred to above would, as a result of the bias, be greater on the after hook than forward, i.e. greater than half or 2250 kgs. This might be part of the explanation as to why the after hook opened first, particularly because forward and after hooks were found with comparable minimal weardown of interlocking surfaces. It would also explain why the forward hook also opened when the whole weight of the boat transferred to it. The opening forces would have more than doubled.

4.26 Another part of the explanation for the reason of the after hook releasing first could be that the cable at the outer clevis connection has a greater tendency to be misaligned with the longitudinal. This is because, from it's position in the after part of the boat is a short run to the centrally located hook assembly, whereas the longer longitudinally aligned run to the forward hook assembly does not induce the same misaligning forces.

4.27 The Cam Plate(s) – Fig.2 ④, must have been out of position for the above to occur. They must have been below the horizontal indicated in the instruction close to the helmsman's feet (Photo 2). If they had not been the hooks would have been effectively locked. This indicates therefore that the crew did not correctly interpret this signal of danger, assuming they observed it at all.

4.28 The status of the hooks can be detected by observation of the under-deck Cam Plate (Photo 3 and Photo 7) being in a position such that its upper edge is horizontal, or more correctly, parallel to the neighbouring structure (see Photo 2 instruction plate). In any other position the Lock Piece ⑦) (Figure 2) will not be fully meshed with the tail of the hook.

Operational Procedures are analysed as follows:

4.29 The decision to exercise two boats is unusual. Vessels rarely have the opportunity to be in a sheltered location with access to the water on both sides of the vessel. It would appear that an opportunity was seen to take advantage of the circumstances at the berth where calm water was available. This enabled the Master to comply with the requirements of SOLAS to exercise boats in the water at intervals and thus avoid having to carry out the operation in more hazardous circumstances.

4.30 The Master's actions in seeking to maximise his training and exercise opportunity indicates a responsible regard for achieving required drills within suitably sheltered environments. Despite the unfortunate, but thankfully not fatal outcome, the participants will have learned much from the sequence of events that developed. Calamitous and life threatening exercises however are unacceptable as a training aid. They will probably have done much more to discourage the participants than to encourage them.

4.31 Conversely to the above it is unfortunate that despite the issue of the Bahamas Maritime Authority Information Bulletin no: 117 describing the use of FPDs, these were not being used on board the vessel. Had the boat been fitted with FPDs the boat could not have fallen to the water, even if both hooks had failed. (see Appendix II)

4.32 In the event it was malfunction of equipment that initiated a single point of failure between safe and unsafe conditions. This must have been compounded by failure of operational practice, otherwise correct positioning of Cam Plates would have locked the hooks closed. The available evidence strongly suggests that either the Cam Plates were not checked, or the participants misunderstood the significance of their positions

4.33 The mechanism relies on a single point of failure. There are no safety locking devices applied directly to the hooks. The only safeguards, apart from the diagram indicating correct position of the under-deck cam, apply to other parts of the mechanism. Crews are therefore exposed to dangers inherent in the unprotected equipment because if failure occurs to the intermediate sections, and the under-deck cam is not in locked position as was the case when the double articulation occurred at the connection to the operating lever, there is nothing to prevent opening of the hook.

4.34 The abuse damage found on the gears and crank of the after release gear, added to the damaged stop plate strongly suggests that the mechanism has not been fully understood by crews in the past. The significance of the release lever being out of position and other linkages similarly has apparently been missed.

4.35 The lack of recording of any malfunction is indicative of poor communication between vessel and managers and inadequate monitoring of faults. Had a system been in place the faulty operation could have been investigated and corrected. At very least the operations could have been suspended until the linkages were found to be operating correctly.

The lifeboat design can be further analysed as follows:

4.36 The lifeboat scenario using two falls is in fact worse than a simple single point of failure as the successful suspension of the boat is dependent on both falls being in place. The two falls together are therefore a single unit of failure and failure of one half of this unit will result in a total failure situation that is unlikely to be tolerable.

4.37 The single point of failure evident at each of the hooks is further compounded by another at the turnbuckle which has a single inadequate locking arrangement. The arrangement is evidently unable to prevent inappropriate rotation and additional articulation in the linkages.(see 4.15, 4.16 and Appendix III)

4.38 Had only one hook failed and the forward hook remained closed, provided the boat's structure was able to remain intact – an area of secondary failure recorded in a number of other accidents – the boat would have rotated out of the horizontal and into the vertical. Internally the boat's motions would have been disorientating and securing of occupants would be tested to extremes. The accelerations on humans though similar to or possibly lower than those caused in a free fall type of boat to the water would be at or beyond the limits of human tolerance. This would be because of the directions in which the forces are acting relative to the restraining seat belts and the resulting intensity of these forces on concentrated areas of the body. The least consequence that could be expected would be serious injury. Evidence of other accidents has shown that fatality is very strongly probable.

4.39 The failure was not limited to a single hook. After the first failure - that of the after hook - the load on the forward hook, which would have been doubled and changed in direction, was able to overcome the mechanism constraints and it was forced open. It is evident from the analysis above that it is probable that the hooks were never in a locked condition. Checks by personnel should apply to both hooks and the helmsman should be satisfied that they are both positive before proceeding.

4.40 The lifeboats aboard NOVA BRETANGE were manufactured by Shigi. The release gear was also manufactured by the same company. The arrangements in the boat included a set of instructions referring to the resetting arrangements of the hooks (Photo 9). Whilst the instructions are comprehensive, the mechanism is complex and it is debatable whether the whole arrangement and instructions could be regarded as intuitive.

4.41 The need for lifeboats to comply with the requirement within SOLAS to be released whilst still on load has led to a large number and variety of different systems with very little standardisation amongst them. Some systems require a handle to be pulled as does this one, but others have a different orientation. Some systems have additional hydrostatically activated interlocks to act as an additional safeguard against boats being released from a height above the water but even these must have a means of overriding the facility in the event of its failure.

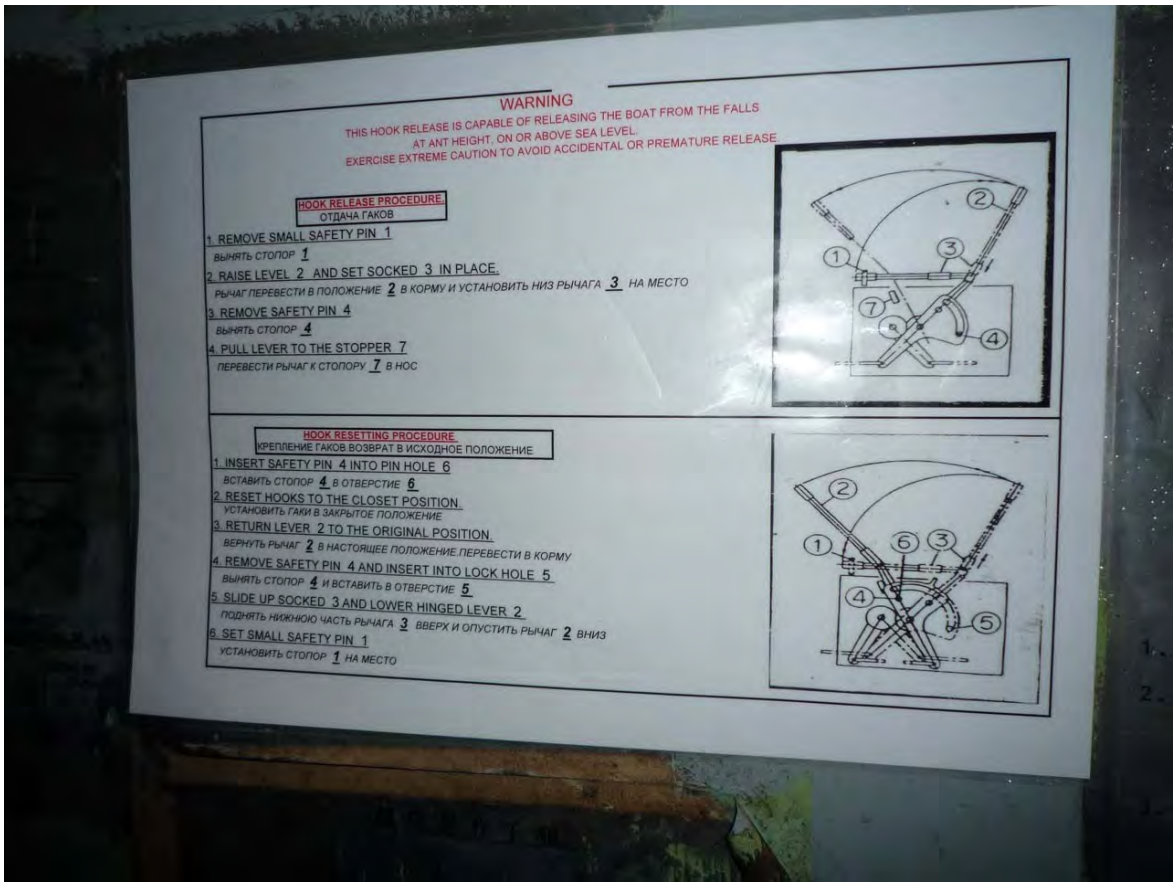


Photo 9: Instructions for Operation of the release mechanism and hook resetting procedure.

4.42 The Shigi SZK – 5 does not have a hydrostatic interlock but if, as is usually the case with other designs, the interlock was designed to inhibit the control lever, it would not be effective in preventing the type of failure that did occur. One view could be that hydrostatic release mechanisms introduce another layer of complexity which is itself subject to failure.

4.43 The Shigi SZK – 5 design does incorporate a system of interlocks namely safety pins and the articulation of the control handle, which requires raising to the operating position before any activation of the mechanism can occur. This inhibits the use of the control but as can be seen from analysis above, serves no purpose in preventing failure in any part of the system between the control and the hook. The system is thus subject to a single point of failure, namely the hook or any part of the mechanism between it and the control.

4.44 In addition to the deliberate action requirement above, the Shigi system has another check on the status of the hook mechanisms. The hooks at each end of the boat are operated by a system of interlocking levers between the hook ① and locking piece ⑦. The final interlocking cam is visible under the deck, designated in manufacturer's drawings as the Cam Plate ④. This contrasts with many systems in which most of the linkages and mechanism are concealed within the casings of the various assemblies and very often above deck level. The setting of this Cam Plate ④, neutralises any opening couples when in the correct position, as per the instruction poster near the helmsman's feet, i.e. the hooks, with the

Cam Plate in the horizontal position are locked shut. Unfortunately, if the Cam Plate is not correctly positioned it provides a lever that is able to transmit forces into the system of linkages (cables, turnbuckles and levers) between that position and the control. If any part of that system allows sufficient play the hook may reach a position whereby it releases. There is no locking arrangement to ensure the Cam Plate is held in the correct position. There could be. (see recommendations)

Photo 10: Underdeck Cam Plate visible for status check. Note this is incorrectly set.

4.45 The instruction plate (Photo 3) relating to the Cam Plate ④ setting is an engraved plaque. It does not have any highlighting features, it should have. Similarly the Cam Plate (Photo 10) is a neutral colour. It could be painted in a highly contrasting colour so as to emphasise its importance.

4.46 The decision to disconnect the boats from the falls is entirely within the requirements of SOLAS but, ignoring the competence of the crew and their natural instinct for self-preservation, there is very little to prevent the users doing so inadvertently.

The "Instructions for Operation" sign in Photo 9, located on the starboard side of the engine housing, beneath the feet of the helmsman has a warning header in red indicating that:

"THIS HOOK RELEASE IS CAPABLE OF RELEASING THE FALLS AT ANT (SIC) HEIGHT ON OR ABOVE SEA LEVEL.

EXERCISE EXTREME CAUTION TO AVOID ACCIDENTAL OR PREMATURE RELEASE".

It is debatable whether this can be considered a suitably robust prevention of accidental release. Apart from the typo (ANT should be ANY) the instruction attempts to address the human element in the operation. It could be better placed, e.g. a large sign in front of the helmsman and close to the operating lever. The current arrangement is close to the operating lever but is not directly visible to the helmsman as it faces sideways and away from him (her).

4.47 The hook release procedure requires a number of actions, namely:

- **Remove small safety pin** (1):
  This pin holds the operating handle in a clip adjacent to the deck plates.

- **Raise level**(sic) (2) and set socked (sic) (3) in place:
  This describes the action of lifting the lever to its operating position and allowing the sleeve described as the socked (meaning presumably "socket") to slide down the handle, locking it to the operating lever of the mechanism.

- **Remove Safety Pin (4):**
  This pin is below the floor plates and prevents the operating lever from moving. From this point the mechanism is unprotected against inadvertent operation, but this requires the lever to move as below. It is noted that this pin is attached by a light chain, which in the case of the subject boat was noted as being detached. This could lead to loss of the pin.

- **Pull lever to the stopper:**
  This action is the principal action that releases the hooks. The meshed gear wheels attached to the handle rotate in opposite directions and the levers attached to them pull the cables via the turnbuckles. These in turn lower the under-deck Cam Plate that allows the Hook Bearer to lower and the Lock Piece to release the hook.

4.48 The care taken to re-set the hooks before lifting was itself a sound precaution against malfunction of the same. When difficulty was encountered, the decision to apply experience in the form of the bosun was a sound precaution. The multiple re-setting of the hook was a precaution, however that may have created an illusion of safety, because it must have been the case that the hooks were not correctly set.

4.49 The safe status of the hooks was an illusion because they had not been correctly re-set. The Cam Plate, if it had been properly positioned, would have presented a bearing surface tangential to the Hook Bearer Boost Plate that was perpendicularly above the pivot pin of the cam (see Figure 2). With the Cam Plate in this position there could not be any rotating force on the cam and the Lock Piece would have to remain enmeshed with the Hook.

4.50 The fact that in the accident the Hook released indicates that the Lock Piece was displaced under load. This occurred despite a high ratio leverage at the Cam Plate. It is an undeniable fact that it happened.

4.51 Apart from incompetence, which is often cited as a reason for accidents, there is a major difficulty for the helmsman to have sufficient external visibility to determine the height of the craft relative to the water (see Photo 11). The waterborne condition once reached will be unmistakable because of the physical disturbance of the craft's attitude but in very severe conditions – the type that may be more likely during an abandonment – the trough following a wave may be sufficiently deep that release into it after the wave has struck may be several metres drop. The process is not simple. The restriction on visibility compounds the difficulties facing the helmsman.

Photo 11: Lifeboat immediately after the accident. Note in relation to 4.45 above, the positions of the viewing apertures available to the helmsman and directions in which they face.

4.52 (i) In the lifeboat during the exercise the three occupants would have been seated, two on side benches with no external visibility and the third in the helmsman's seat with very limited visibility.

(ii) During the hoisting operation after the successful launch the boat would have been subject to bouncing movements as the hoist started and stopped. This is because davits usually flex under the load of the lifeboat.

(iii) When the hook opened there would have been a sudden acceleration downwards in the after end followed immediately by a violent sideways impact as the hull contacted the davit structure. The movement would then have changed violently in an outboard direction, with the boat rolling outboard and falling towards the water.

(iv) Because the forward hook remained closed initially this would have converted the fall into a rotation about the forward end and what had previously been horizontal would have been rapidly changing in both lateral and longitudinal aspect relative to the vertical.

(v) When the forward hook opened the roll outboard would have continued as the keel of the boat probably intercepted the deck edge and this probably prevented a complete upending of the craft but the fall would then accelerate. The occupants may even have then experienced a very brief period of weightlessness in the 12 metre fall before the catastrophic impact with the water.

(vi) Damage to the superstructure of the boat suggests this impact was in an inverted attitude but with little or no outside visibility the occupants could not have been expecting forces in this direction (towards the canopy). At some point the buoyancy tank attached to the portside internal surface of the superstructure separated from the laminated structure and it is understood at least one of the occupants was contacted by this bulky moulding. Seat belts would have been at extreme stress and would have imposed dangerously concentrated forces on the bodies of the wearers.

(vii) Water would, at the same time enter the boat through the breaches caused by the impact and if inverted at the time the situation for the occupants would have then included a severe drowning hazard. The boat righted itself. In the dark interior of the craft this would have been a movement involving more stress on the bodies of the occupants, which by this time were almost certainly suffering serious injuries.

(viii) The motions would have been further disorientating and a period of time then elapsed until help arrived to bring the boat alongside and remove the three, now seriously injured persons to medical facilities ashore.

5 CONCLUSIONS

5.1 Irrespective of whether there were failures in the mechanical systems or operational procedures, the boat could not have fallen if Fall Protector Devices (FPDs) had been in place. FPDs would have provided an alternative load path at each of the hook connections or could have involved a secure locking of the same hook closed. These FPDs however were not in place despite the recommendation for their use as outlined in Bahamas Maritime Authority Bulletin 117 and subsequently reinforced by IMO MSC Circ. 1327. The latter is subject to implementation by administrations in local information systems. It was only issued in June 2009 but BMA Bulletin 117 was issued in August 2008. Refer Appendix IV.

5.2 The accident was the direct result of the failure of a number of systems, because of the lack of redundancy of safety systems the situation deteriorated rapidly to a catastrophic conclusion. This was because the suspension system of the boat, which consisted of a double fall arrangement was itself subject to a single point of failure when a single part of that system - the after hook - opened when the craft was almost fully stowed. The boat was then exposed to a fall of approximately 12 metres to the sea surface impeded only by contacts with the davit structure and possibly the deck edge on the boat deck. The forward hook remained connected for a very brief period until it too opened under the much increased load.

5.3 The crew of the lifeboat appear to have failed to ensure that the locking Cam Plate of the hooks – both forward and aft – were in the correct position to lock the mechanisms.

5.4 The instructions for setting of hook mechanisms do not emphasise forcefully enough particular dangers in failing to operate the system properly.

5.5 The lack of a hydrostatic release does not detract from the safety of recovering the craft. There are three deliberate actions that must be undertaken before the release mechanism can be activated. These actions are:

- Remove the pin from the folded down Release Handle
- Lift the handle into alignment and engage locking slide
- Remove safety pin from the quadrant of the crank attached to the after cable.

Without all three actions being completed the Release Handle mechanism cannot open the hooks. This however creates an illusion of safety because it does not prevent the hooks from opening under load. regardless of the position of the Release Handle. (See below)

5.6 Hooks do not have locking arrangements applied locally at the hook. Instead the safety locking devices are at the opposite end of a system consisting of a number of linkages between the hook and the controlling mechanism. As a result there is no protection against the hooks opening in the event of them not being correctly set or excessive play in the control system..

5.7 The recovery operation in particular is dangerously exposed to failures in re-setting arrangements that depend on critical alignments of cables, turnbuckles and cranks, as well as fine tolerances of adjustment. Most of the critical linkages are below plate level in the bottom of the lifeboat and out of immediate sight.

5.8 Cable constraints in the design of the boat are of a ball joint type allowing inappropriately large angles of lateral as well as vertical displacement of the linkages connecting them to the cranks of the release handle mechanism. Displacements in these directions can allow for an additional articulation in the linkages at the outer end of the adjusting turnbuckle allowing the hooks to open with the Release Handle static in the re-set position.

5.9 The locking nuts of the turnbuckles are ineffective in preventing rotation of the outer clevis pin joints between the cranks and the cable end. There is no other locking arrangement to maintain the critical orientation of the turnbuckles. As a result the adjustment turnbuckles are each subject to a single point of failure, which is unacceptable when they can permit catastrophic consequences as evidenced by this accident.

5.10 The hook arrangements on the boat in the accident are readily suited to more than one form of FPD with very minor load verification for slings or minor modification for pins.

5.11 Insufficient evidence of maintenance by the vessel's operators was available to verify that adequate maintenance had been carried out. The ISM Safety Management System could be improved in this respect.

5.12 Lack of knowledge of the operators and ship's staff in relation to the existence of BMA Information Bulletin 117, outlining the use of FPDs indicated a less than satisfactory awareness of safe operating procedures and measures to improve known problem areas.

5.13 It is not possible to eliminate causes down to a simple single failure in equipment or procedures. The danger of doing so would be to miss the many complex elements that can contribute to an accident.

Those who operate survival craft have a duty of care, those who manage the vessels a duty of care to their employees and finally designers and manufacturers of survival craft have a duty of care to their customers.

"It shall be the duty of the employer of employees aboard to ensure, so far as is reasonably practicable, the health and safety of employees and other persons aboard ship who may be affected by his acts and omissions" ***- Bahamas The Merchant Shipping (Health and Safety—General Duties) Regulations 1984***

6 RECOMMENDATIONS

General

6.1 FPDs should be used on any lifeboat (or rescue boat) fitted with on-load release hooks that are not of a design incorporating a stable, fail-safe condition when not activated. On-load release hooks should be capable of being mechanically locked in the closed position during lifting operations. Where practicable and with authorisation by the Manufacturers hooks should be modified to accept lifting pins.

6.2 If not suitably fitted, boats should have their hooks modified and the modifications tested and verified. In the interim until such measures can be put in place, crews should not be exposed to dangers inherent in the unprotected equipment.

6.3 Until hooks can be modified or replaced and if FPDs cannot be fitted in an approved form the boat should not be manned during drills. This situation however should not be allowed to prevail as it potentially eliminates any form of drill and will rapidly de-skill the operatives. The alternative of boarding boats by ladder after they have been lowered to the water should also be recognised as a hazardous operation and if, after assessment the hazards are shown to create intolerable risks, the practice should not be carried out. Until safer designs of hooks can be fitted, boats fitted with on-load release hooks should always be fitted with FPDs and crews should become familiar with them. (See Appendix II for FPD arrangements).

Ship Owners and Managers

6.4 Crew training should include all aspects of operation of on-load release mechanisms.

Primary importance should be given to the hazards possible with the gear and how to assess the associated risk. Detailed training should include the re-setting procedures for recovery of craft after in-water exercise. Experience shows that it is at such times when most accidents happen. In particular FPDs should be re-fitted before the boat is hoisted more than 1 metre above the water.

6.5 Crew should not enter any boat fitted with on-load release hooks without first ensuring that FPDs are in place.

This includes all exercises and maintenance operations as well as actual emergencies. FPDs should be in place for actual emergencies because the fully loaded boat is more susceptible to failure than one loaded with a small crew. With this in view, FPDs should be in position at all times except when the boat is finally waterborne. They may be removed shortly before the boat enters the

water. Concern has been expressed elsewhere that maintenance lugs – the usual point of attachment of FPDs – may not be tested to the full load of the boat. If this is the case they should ultimately be strengthened accordingly but in any case removal of any intercept such as an FPD is not a suitable solution. Even if the tested strength remains lower than the full boat a partial safeguard is better than no safeguard at all. The option of not using the boat, as in a drill, is unlikely to be available in an evacuation and the master is faced with enough adversity without adding the possibility of a fall of a full lifeboat. The modification of gear to either take larger loads on attachment points or to incorporate locking pins should be treated as an urgent requirement

6.6 A planned maintenance programme should be instigated that follows any procedures recommended by manufacturers and which is fully documented.

6.7 The Safety Management System should include not only the planned maintenance of the boats as above but also a full inventory of bulletins and other notifications from the flag administration and other relevant authorities. The system should include recorded evidence of implementation of any measures and acknowledgement that the officers and appropriate crew members are aware of the content of the notifications.

Manufacturers, Ship Owners and Managers

6.8 Signage in any boat should be adequate for the easy interpretation of actions necessary for the safe operation of any gear in the lifeboat and especially on-load release hooks.

The position of the critical signage should be visible to the helmsman without having to leave his(her) seat. If these conditions are not met the signage should be repositioned and, if necessary, re-written to make suitable emphasis of critical operations and in language that is understandable to crews. Pictorial instructions are to be encouraged.

Manufacturers

6.9 The Shigi design featured in this report lends itself to an internal FPD pin arrangement.(see Appendix II) or similar intercepting arrangement at the hook mechanism.

The Cam Plate, which in this boat is equipped with a hole in the centre of the interface curvature, could align with cheek plates on either side in such a way that a large and significant pin could be inserted through holes in the cheek plates aligning with the locked position of the Cam Plate. The significance of the pins should be their colour and size, which should be contrasting with surroundings and large. The pins could also be fitted with a "flag" similar to those used on aircraft nose wheels during tugging operations. The training of crew should incorporate a specific action in which the helmsman orders the pins removed (just above the water) and the crew members carrying out the action then give audible acknowledgement and display the flag to the helmsman before stowing

the pins in a purpose made holder for the afloat stage. Recovery should be a reversal of this process with the pins being visible in their correct positions. The Shigi boat is adaptable to this procedure because the locking mechanism is below decks and visible in the spacious interior of the boat. **Other similar arrangements could be equally acceptable. This arrangement should not be regarded as prescriptive.**

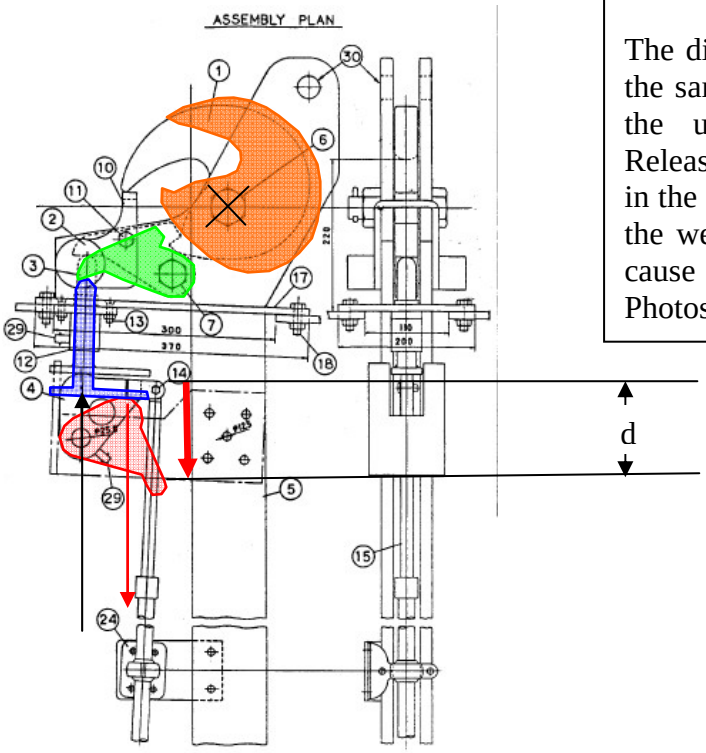
6.10 The Shigi boat's release handle mechanism should be modified to eliminate the single point of failure in the turnbuckle adjusters on each cable. The arrangement shown in Appendix III is one that has been devised by a repair company specialising in lifeboats and who are familiar with the Shigi mechanisms.

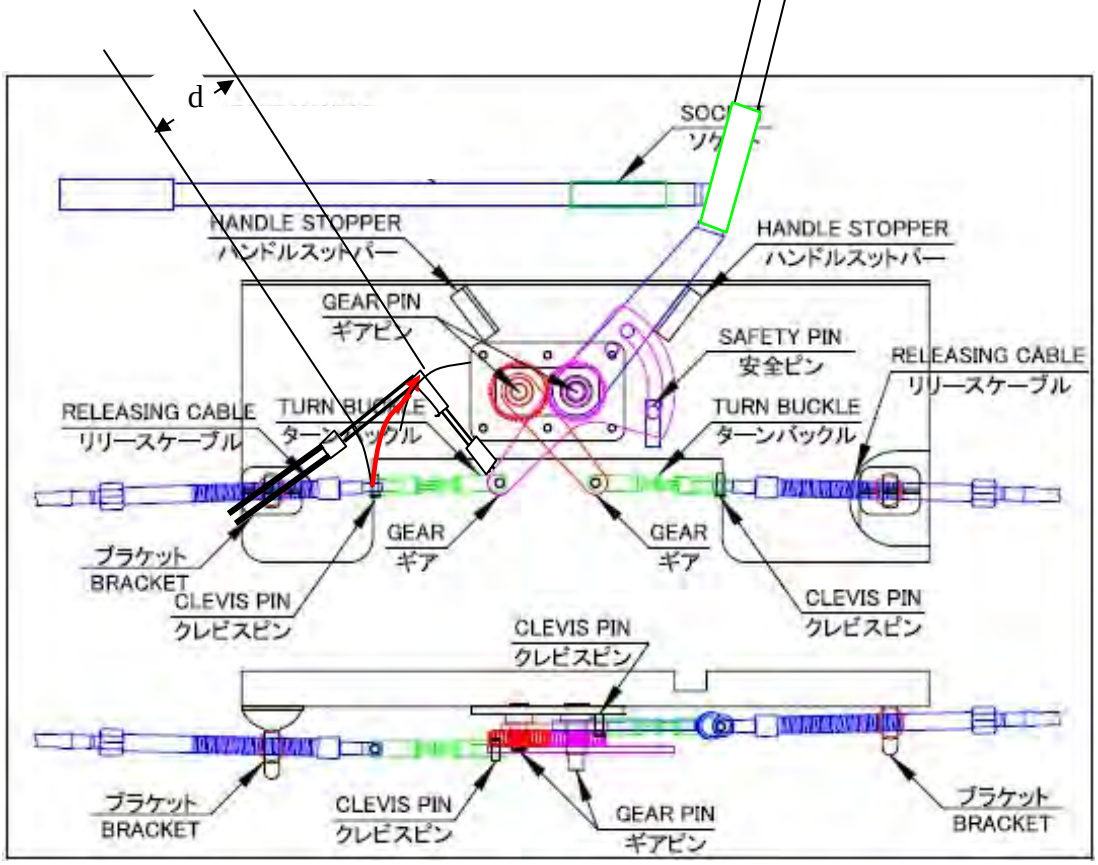
APPENDIX I

HOOK OPENING (UNPLANNED)

In the diagrams below scale is approximately the same for both drawings.

The displacement “d” due to the hook opening is the same as the displacement of the turnbuckle at the unintentional second articulation of the Release Handle assembly. If the Cam Plate is not in the locked (horizontal) position it is possible for the weight of the boat to override the levers and cause displacement “d” . See also 4.8 – 4.21 and Photos 6 and 7





APPENDIX II

FPD ARRANGEMENTS

N.B The suggested arrangements included below should not be regarded as prescriptive. Alternative arrangements may be equally effective but they should have proven equivalence in security of the system and simplicity of operation.

1: Slings or Strops.

Above and Right: After hook arrangement on the SHIGI boat showing side lugs that are suitable points of attachment for FPD Slings.as in the arrangement below.

Note the close proximity to the access hatch, making this arrangement even more suitable as an immediate modification.

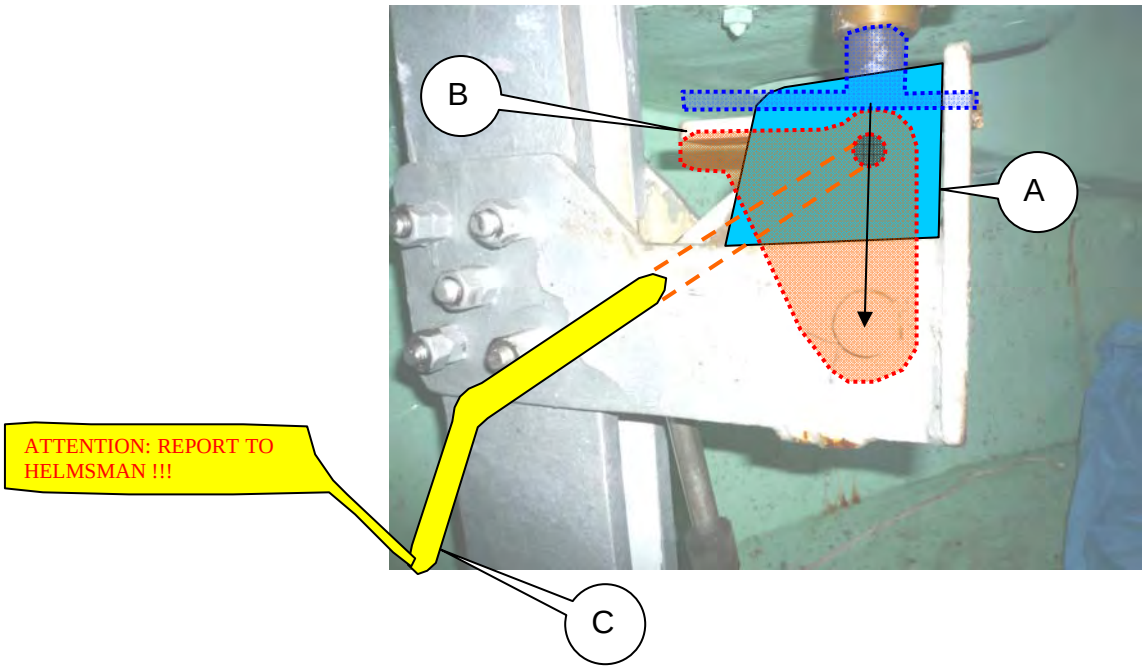
Note: Slings are more suitable as FPDs than are Strops as they do not have eye splices. This eliminates additional points of weakness. It also enables a shorter connection where this may be necessary.

FPD ARANGEMENTS

2: Pins.

Left: The existing arrangement in the Shigi boat and

Below: One possible modification .



The Shigi gear has a distinct set of advantages over some of its competitors:

- The principal “locking” elements of the hook assembly are below decks;
- The boats are constructed with relatively roomy and accessible interior spaces; and
- Key elements are visible from a good distance away in the boat.

The following is a suggested arrangement included to illustrate the points to be addressed. It should not be regarded as the only prescriptive sollution. Other methods may create an acceptable safeguard.

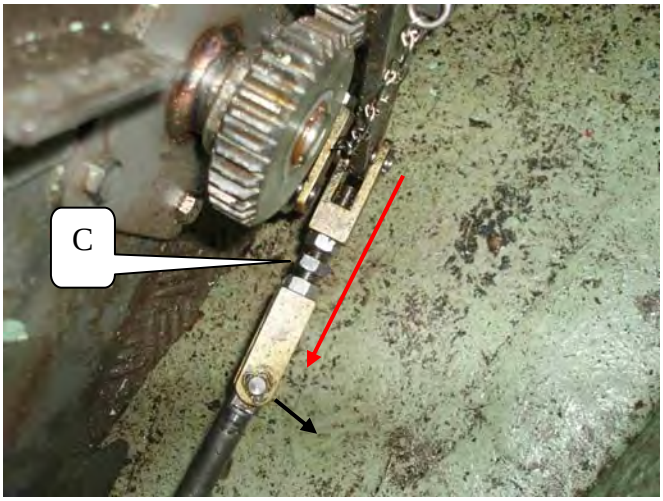
A minor modification could be made involving additional cheek plates (A in photo) fixed on both sides of the assembly in the area between the existing cheek plates and the end plate. These cheek plates would be drilled, each with a hole corresponding to the existing hole in the Cam Plate when it is in the locked position (B), i.e. directly above the fulcrum pin (indicated by black arrow). A removable pin (C) could then be inserted thereby preventing any movement of the Cam Plate away from the locked position. The pin could also have a highly visible“Flag” with important instructions

Procedures should be developed that require the pin to be in position at all times except when the boat is waterborne or nearly waterborne. The pins would only be removed on the orders of the Helmsman when the boat is just above the water (less than 1 metre). The crew members – one forwardc and one aft - designated to remove the pins would REPORT THE PINS REMOVED TO THE HELMSMAN before the boat is finally lowered into the water.

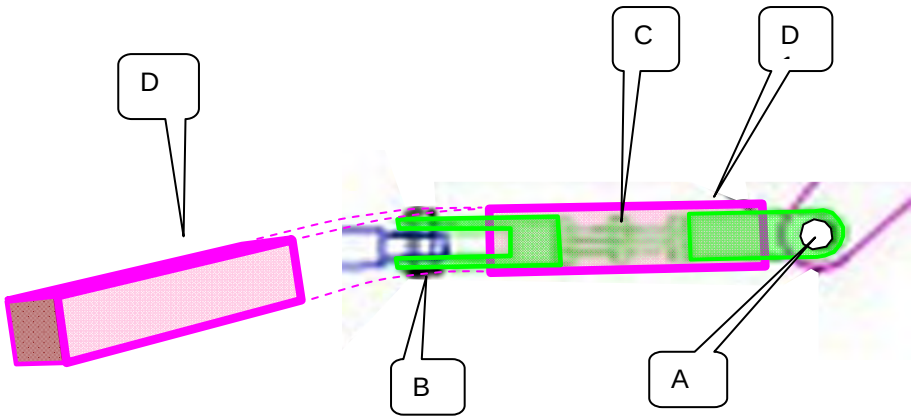
Recovery would be a reversal of the above, having re-set the hooks when the boat is away from the falls the pins would be inserted before any connection is made, thereby ensuring that the Cam Plates were in the correct position to lock the hooks closed. The lifting links should always be inserted into the hooks through the Link Stopper – the weighted gat that retains the links in the hook. The existing procedure of stopping the hoist just above the water is worthy of being retained as connection can require operatives to leave their seats. The break would be a good time to make repeated checks that the pinms are fully in position AND REPORTED BACK TO THE HELMSMAN as well as all crew members being properly seated with their seat belts on. The hoist can still suffer swinging and possible contacts with the ship’s side.

APPENDIX III

TURNBUCKLE SECURING



In the photo above the turnbuckle adjuster has been correctly adjusted with the two clevis pins at right angles to each other. In the photo the reset lever has begun its travel towards the re-set position and it can be seen that the clevis serving the after cable connection (bottom of picture) has already begun rotating out of the right angle aspect to its partner. The locking nut on the adjuster (C) is unable to resist the torsional stress caused when the cable end is displaced outboard (arrowed black) during the compression movement (arrowed red). The locking nut amounts to a single point of failure.



A solution was suggested by the repair yard which they have previously fabricated on a similar craft. In the drawing, the square section sleeve (D) is fabricated to fit over the turnbuckle. Its length is such that it will overlap the sections but is not so long as to prevent shortening adjustment between the two clevis pins (A and B). The turnbuckle would first be adjusted to the correct length. The outer clevis B would be removed. The sleeve would be placed over the turnbuckle in the correct orientation as shown. The turnbuckle would then be reconnected to the cable and B replaced. The resulting assembly prevents inappropriate rotation. It eliminates the single point of failure.

APPENDIX IV

Issue Date: 10 August 2009 Rev: 02

BMA INFORMATION BULLETIN No. 117

LIFEBOAT SAFETY – THE USE OF FALL PREVENTER DEVICES (FPD)

Guidance and Instructions for Ship-owners, Managers, Masters, Bahamas Recognised Organisations and Bahamas Approved Nautical Inspectors

This Bulletin should be read in conjunction with MSC Circulars MSC/Circ.1327 and MSC/Circ.1206 Rev.1

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1. INTRODUCTION

1.1. This Bulletin is intended to support existing BMA advice and guidance issued relating to enhancing the safety of personnel when using lifeboats which feature on-load release gear. Since this Bulletin was first issued in August 2008 the use of Fall-Preventer Devices (FPD) has been considered at IMO and detailed guidance is available in MSC circular MSC/Circ.1327.

2. ACCIDENTS WITH LIFEBOATS

2.1. While the number of accidents remains small in comparison with the number of vessels in the Bahamas fleet the consequences of accidents can be unacceptably high. With this in mind measures have already been implemented to limit the exposure of crews to the hazard associated with on-load release gear failure by allowing lifeboats to be initially lowered and recovered without personnel onboard during drills[2].

3. REPLACEMENT OF HOOK ARRANGEMENTS

3.1. In recognition of the problems associated with this matter the BMA has agreed procedures with some Recognised Organisations to facilitate the retro-fit of modern designs of on-load release gear which feature enhanced safety. All Owners of Bahamian ships are encouraged to assess existing hook arrangements on board in order to identify where improvements, if any, can be made

[2] MSC/Circ.1206 Annex 2 para 2.3.2

4. INTERIM SAFETY MEASURES

4.1. The Bahamas Maritime Authority has noted that the use of fall preventer devices (FPD) has been implemented on many vessels. Their use allows lowering and recovery of the boat with personnel inside with enhanced safety and familiarisation benefits.

4.2. FPD are intended to protect against the consequences of an unintended release of the hook. The safety pin type consists of a steel pin which passes through the cheek plates of the release gear to physically prevent the hook from releasing by locking it in the engaged position and many modern designs now feature such safety pins.

4.3. An alternative method used for older designs which do not feature safety pins is to fit resilient strops or continuous slings across the on-load release between a fixed strong point on the lifeboat and the falls block ring or shackle. The resilient FPD will not prevent the on-load release gear from releasing but will prevent hazardous consequences.

4.4. The BMA recognises the overriding authority and the responsibility of the Master to make decisions with respect to safety, as set out in the ISM Code 5.2, and consequently accepts the use of FPD when advocated by the ship management Company. In such cases procedures for use, inspection and maintenance are to available to ship's crew and documented in the ship's Safety Management System. The professional judgement of the Master is necessary in deciding the occasions and circumstances when FPD are installed and used, such as when the suspension hooks of the craft cannot be secured in a fail-safe i.e. "closed" condition when at any significant height above the water.

4.5. The Bahamas Maritime Authority has no objection to the use of FPD on Bahamian registered ships in association with any safety drill or exercise.

5. USING FALL PREVENTER DEVICES

5.1. Any FPD installed must be fit-for-purpose. The proposal to use such a device must be subject to an engineering analysis to ensure that the device and existing lifeboat structure and arrangements are capable of withstanding any loadings which would result from the failure of the on-load release gear with the boat in the fully-loaded condition and suspended from the davits. A factor of safety of 6 should be the minimum used in such an analysis. All materials used must be suitable for use in the marine environment.

5.2. Resilient FPD must be continuous slings or strops of a type which have permanent end loops and must be of a suitable length to ensure minimal drop in the event of premature release of the hook arrangement. Strops must be dedicated to lifeboat use and should be suitably identified to ensure that they are not used for any other purpose.

5.3. Continuous slings have an advantage over strops in that they possess fewer points of splicing (potential failure points) and can be arranged in shorter lengths. They also can be released in an emergency (when waterborne) by cutting a single member of the sling.

5.4. All such FPD should be protected by an outer cover that protects them from damage or degradation from chemical contamination or ultra-violet light. The outer covering should not be contributory to the overall tensile strength of the sling or strop.

5.5. In selecting FPD Owners must ensure that a comprehensive risk assessment is carried out to ensure that nothing is done to compromise the effectiveness of the operation of the release gear. This is particularly important where the installation of a safety pin is considered and Owners must not make any modification which adversely affects the strength and type-approval of the hook and release gear arrangement.

5.6. Companies must ensure that suitable procedures are implemented to ensure that individuals involved in the lifeboat launching are fully trained, familiar and competent in the maintenance, inspection, installation and removal of FPD. All FPD should be thoroughly examined prior to each use and replaced if any signs of damage or significant deterioration are found. Owners should also draw up a schedule for overload testing and replacement.

5.7. Where FPD are used suitable clear and simple warning notices should be placed inside the lifeboat at the release gear access hatches at each end of the boat so as to ensure correct use of the devices.

.

Examples of FPD

Continuous sling in place over-riding on-load release

FPD taking load during exercise, simulating premature release of on-load hook. Note boat is not waterborne but suspended just above the water – a safety precaution for avoiding injury to personnel or damage to structures during the exercise.

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Ref. T4/3.01

MSC.1/Circ.1327
11 June 2009

GUIDELINES FOR THE FITTING AND USE OF FALL PREVENTER DEVICES (FPDs)

1 The Maritime Safety Committee, at its eighty-sixth session (27 May to 5 June 2009), approved the Guidelines for the fitting and use of fall preventer devices (FPDs), set out in the annex, following the recommendations made by the Sub-Committee on Ship Design and Equipment, at its fifty-second session.

2 The use of FPDs should be considered as an interim risk mitigation measure, only to be used in connection with existing on-load release hooks, at the discretion of the master, pending the wide implementation of improved hook designs with enhanced safety features.

3 Member Governments are invited to use the annexed Guidelines when approving the use of fall preventer devices (FPDs), and to bring them to the attention of all parties concerned.

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MSC.1/Circ.1327

ANNEX

GUIDELINES FOR THE FITTING AND USE OF FALL PREVENTER DEVICES (FPDs)

1 Background

1.1 In 1986, on-load release hooks for lifeboats and rescue boats were made mandatory in the SOLAS Convention, in response to Norway's worst offshore accident in March 1980, when the **Alexander Kielland** platform in the North Sea Ekofisk field capsized, killing 123 of the 212 persons on board. These then new SOLAS requirements were considered an important step forward in lifeboat design.

1.2 Some deaths in that accident were attributed to the fact that the lifeboat had no means of release when its weight was on the hook and falls. Therefore, on-load release systems were seen to offer benefits.

1.3 Since the IMO requirements for all ships to be fitted with on-load release systems came into force, there have been a number of serious accidents during drills and servicing.

1.4 Many of these accidents were attributed to either lack of maintenance, poor design or inadequate training. Failures of equipment can result in the premature opening of the on-load hook mechanism, causing the lifeboat to fall from the davits unexpectedly, even with three safety interlocks provided for in the design.

1.5 A number of current designs of on-load release hooks are designed to open under the effect of the lifeboat's own weight and often need to be held closed by the operating mechanism. This means that any defects or faults in the operating mechanism, errors by the crew or incorrect resetting of the hook after being previously operated, can result in premature release.

1.6 A "Fall Preventer Device" (FPD) can be used to minimize the risk of injury or death by providing a secondary alternate load path in the event of failure of the on-load hook or its release mechanism or of accidental release of the on-load hook. However, FPDs should not be regarded as a substitute for a safe on-load release mechanism.

2 Design and operation of FPDs

2.1 Locking pins

The following points should be considered when utilizing locking pins as FPDs:

.1 existing on-load release hooks fitted to ships should **not** be modified by drilling to provide a locking pin insertion point, unless approved by the Administration in accordance with paragraph 4, as this may significantly reduce the strength of the hook;

.2 locking pins should have clear operational instructions located near the insertion point of the locking pin and be colour coded so that it is clear where the pins are to be inserted;

.3 locking pins should be designed so that they cannot be inadvertently inserted in the wrong place;

.4 locking pins should be confirmed to be in place prior to turning out the lifeboat and during descent to the water;

.5 strict procedures, including a warning notice at the release handle, should be in place to ensure that the locking pin is removed before the release mechanism is activated. The handle of the locking pin should be coloured red or a suitable contrasting safety colour and prominently marked with a warning that it must be removed before activating the release mechanism;

.6 the removal of the pin should be achievable quickly and easily without posing any risk to the operating crew designated to carry out the task once the lifeboat has reached the water;

.7 if the removal of the pins requires opening of the lifeboat hatch it should be readily achievable by the operating crew at each device from within the craft;

.8 once the on-load release hooks have been connected to recover the lifeboat, the locking pins should be re-inserted before the boat is hoisted clear of the water. The locking pins should be designed so that they do not interfere with either the lifting or re-stowing of the lifeboat into the davits; and

.9 where provided, fall preventer locking pins should not be used for any other purpose and should be fitted to the lifeboat at all times.

2.2 Strops or slings

Wires or chains should not be used as FPDs, as they do not absorb shock loads. The following points should be considered when synthetic strops or slings are used as FPDs:

.1 where FPDs are synthetic strops or slings and no modifications are required to the lifeboat, the on-load release hook or launching equipment, a functional test should be carried out. The functional test should demonstrate, to the satisfaction of the Administration, that the equipment performs without interfering in the operation of the lifeboat or launching equipment. Strops or slings should be of resilient fibre in construction;

.2 the strops or slings should be issued with an appropriate certificate documenting a tensile strength which provides for a factor of safety of at least six, based on the total weight of the lifeboat when loaded with its full complement of persons and equipment. The strops or slings should be inspected before use and thoroughly inspected by ship's crew every six months. The material of the strop or sling should be rot-proof, corrosion-resistant, not be unduly affected by seawater, oil or fungal attack, and UV resistant. The strops or slings should be permanently marked with the date of entry into service;

.3 strict procedures, including a warning notice at the release handle, should be in place to ensure that the strops or slings are removed before the release mechanism is activated;

.4 the attachment point of the strop or sling to the on-load release hook and the davit falls block should be clearly marked and designed so that any connection device such as shackles cannot be connected to either the wrong part of the block or the wrong part of the on-load release hook;

.5 the release of the strops or slings should be achievable quickly and easily without posing any risk to the operating crew designated to carry out the task once the lifeboat has reached the water. If the release of the strops or slings requires opening of the lifeboat hatch it should be readily achievable by the operating crew at each device from within the craft. Once detached, the strops or slings should not interfere with the operation of the on-load release gear or the propeller;

.6 once the on-load release hooks have been connected to recover the lifeboat, the strops or slings should be reattached to the lifeboat before the boat is hoisted clear of the water. The strops or slings should be designed so that they do not interfere with either the lifting or re-stowing of the lifeboat into the davits;

.7 a strop or sling used as an FPD should be sized and arranged to allow the transfer of load from the hook mechanism to the strop with minimal movement (drop) of the boat in the event of a release mechanism failure. Should a fall preventer strop or sling be subject to an unintentional dynamic shock loading, then the strop or sling should be replaced and the associated attachment points inspected. In such cases, the Administration should be informed as soon as possible and the master should provide a full report of the circumstances of the incident; and

.8 where provided, fall preventer strops or slings should not be used for any other purpose and should be fitted to the lifeboat at all times.

3 Drills, testing, inspections and maintenance of lifeboats and launching appliances

3.1 The ship's master or the officer in charge of any lifeboat lowering or lifting operation should ensure that, where provided, lifeboat FPDs are properly in place before commencing any drill, testing, inspection or maintenance where persons are in the lifeboat.

3.2 The ship's operating crew should be familiar with the operation of the FPD fitted to the lifeboat on their ship. The procedure to be followed should be contained in the ISM Code documentation and the ship's training manual.

3.3 Those conducting training drills and drafting ISM Code procedures should take into account that with certain types of ship such as oil, gas or chemical tankers it may not be possible to use an FPD in an abandon ship situation where the release mechanism of the device is not inside the lifeboat. In such cases, the master should take this into account when considering application of paragraphs 2.1.9 or 2.2.8. Where a different procedure is followed during routine drills compared with an abandon ship situation, this should be clearly described in the ISM Code documentation and training manual.

4 Modification of existing approved on-load hooks already fitted to a ship to incorporate FPDs

The shipowner or original equipment manufacturer should contact the Administration for approval before any modification, such as modifying existing lifeboats and hooks for oil and chemical tankers so that FPDs can be released from within the lifeboat, is made to a hook, lifeboat or davit to accommodate the use of FPDs. Any retesting of any equipment should be agreed and witnessed by the Administration or a recognized organization appointed by them and documented in the relevant approval file.
