Bundesstelle für Seeunfalluntersuchung
Federal Bureau of Maritime Casualty Investigation
Federal Higher Authority subordinated to the Ministry of Transport,
Building and Urban Affairs

Investigation Report 21/06

Very serious marine casualty

Death of two crew members following the crash of a lifeboat of MT OLIVER JACOB during a lifeboat manoeuvre off the coast of Cameroon on 21 January 2006

1 December 2007

www.bsu-bund.de

The investigation was conducted in conformity with the law to improve safety of shipping by investigating marine casualties and other incidents (Maritime Safety Investigation Law - SUG) of 16 June 2002.

According to this the sole objective of the investigation is to prevent future accidents and malfunctions. The investigation does not serve to ascertain fault, liability or claims.

The present report should not be used in court proceeding or proceeding of the Maritime Board. Reference is made to art. 19 para. 4 SUG.

The German text shall prevail in the interpretation of the Investigation Report.

Issued by:
Bundesstelle für Seeunfalluntersuchung
(Federal Bureau of Maritime Casualty Investigation - BSU)
Bernhard-Nocht-Str. 78
20359 Hamburg
Germany

Head: Jörg Kaufmann
Tel.: +49 40 31908300 Fax.: +49 40 31908340
posteingang-bsu@bsh.de www.bsu-bund.de

Table of Contents

List of Figures

1 Summary of the marine casualty

The very serious marine casualty occurred on board the tanker OLIVER JACOB on 21 January 2006 while a lifeboat manoeuvre was being carried out during anchorage in the roads. The crew launched the port side boat that was equipped with a centrally operated releasing gear. The boat was hanging in a gravity davit facility. After completion of the manoeuvre the lifeboat was to be heaved in again. In doing so the boat crew ascertained a problem with the releasing gear safeguard. Without any information being passed on to the vessel command, the boat was hoisted despite this. After the boat had been heaved in completely, two officers discussed the malfunction that had occurred on the release mechanism. They decided to launch the boat again. The two officers and a further crew member manned the lifeboat. After the davits had been swung out and a short veering controlled from deck, the forward hook released. Shortly after this the aft hook opened and the boat turned around its longitudinal axis while falling. This, from a height of about 15 m, resulted in landing on its top in the bow area. After the crash one crew member was able to free himself from the boat that was drifting keel upwards. The other two seamen did not survive the crash.

2 Scene of the accident

Nature of the incident:	Very serious marine casualty, two crew members killed in the crash of a lifeboat
Date/Time:	21 January 2006 / 11.20 h LT[1]
Location:	Cameroon, Kribi Roads
Latitude/Longitude:	φ 02°56,4'N λ 009°44,5'E

Section from Chart 2700, BSH

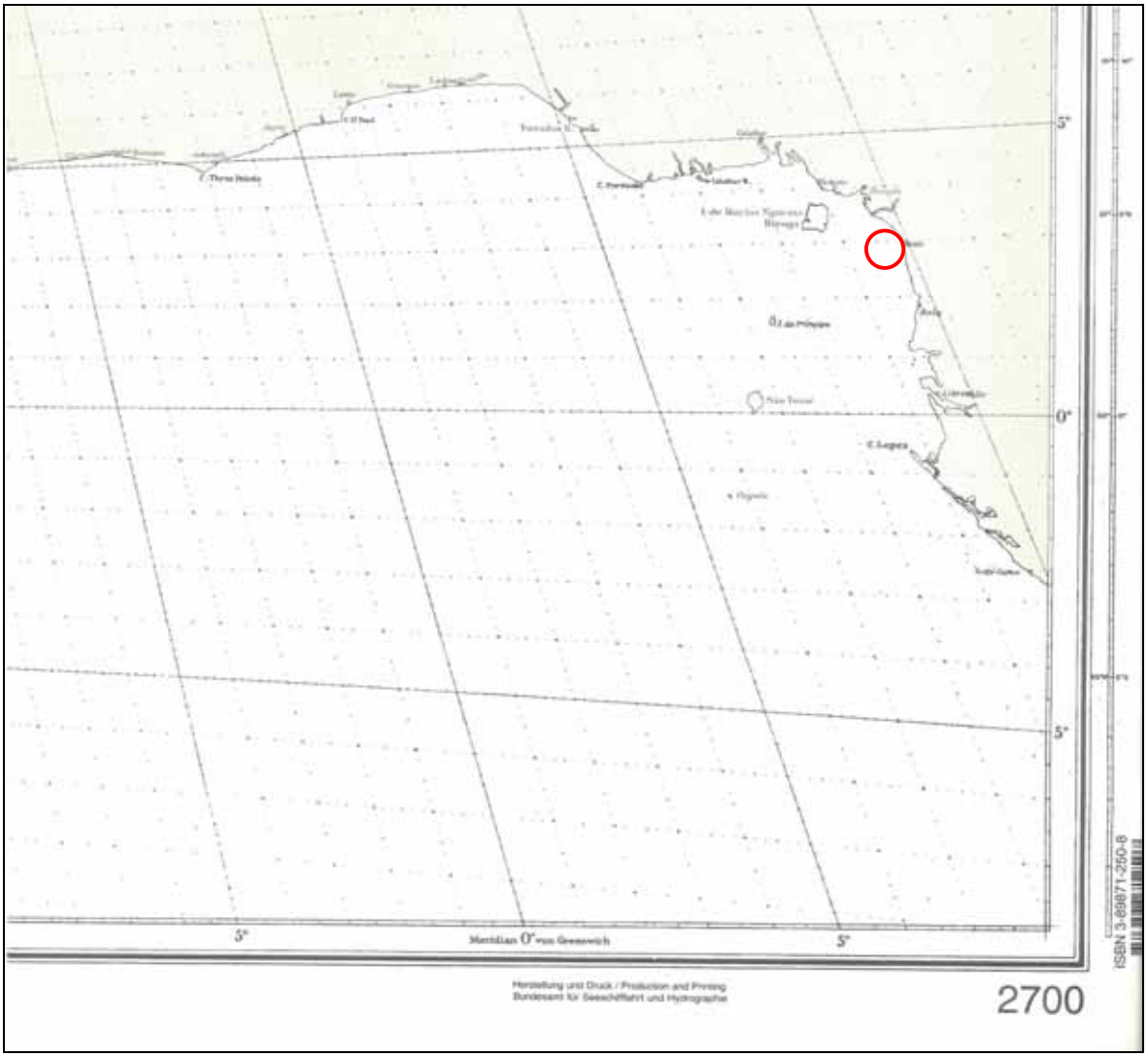

Figure 1: Chart with scene of the accident

[1] LT (Local Time) = CET (Central European Time) - all times in the report are in this time

3 Vessel particulars

3.1 Photo

Figure 2: Photo of vessel

3.2 Particulars

Name of vessel:	OLIVER JACOB
Type of vessel:	Oil Tanker
Flag:	Federal Republic of Germany
Port of registry:	Hamburg
IMO – number:	9175078
Call sign:	DBZQ
Owner:	SAG Unternehmensbeteiligungs-gesellschaft MT OLIVER JACOB mbH & Co. Tankschiff KG
Vessels operator:	Ernst Jacob GmbH & Co. KG
Year built:	1999
Building yard:	Daewoo Heavy Industries, Ltd., Okpo
Classification society:	Det Norske Veritas
Length over all:	274 m
Width over all:	48 m
Gross tonnage:	81,565
Deadweight:	157.326 t
Draft at the time of the accident:	7.20 m
Engine rating:	16,852 kW
Main engine	MAN B&W 6S 70 MC
Speed	15 kn
Hull material	steel
Number of crew	22

4 Course of the accident

4.1 OLIVER JACOB

OLIVER JACOB is a tanker. During this voyage its crew consisted of 22 persons. Due to the size of the vessel, in addition to the second nautical officer, two third nautical officers were also employed. Therefore the master and the chief mate were not integrated in the watch system.

The vessel is equipped with two enclosed lifeboats. Each of which is located on the port and starboard side of the superstructure. Both boats are stowed in gravity davits. The port side boat also serves as a rescue boat for "person-over-board" assignments.

4.2 Course of the voyage

After discharging cargo, OLIVER JACOB had left the Island of St. Croix, US Virgin Islands, on 08 January 2006. On 21 January 2006 at 09.40 h the vessel anchored at a position 4 nm WNW of FSO[2] Kome-Kribi1, Cameroon Oil Terminal, located approx. 10 nm off the coast. It was planned to shift to the terminal the next morning and start loading crude oil there.

4.3 Course of the accident

As there was no wind and no sea, the vessel command decided to carry out a lifeboat manoeuvre. Appropriate approval was obtained from the terminal manager by radio.

The boat drill had started at about 10.20 h. The manoeuvre was conducted under the leadership of the master who was on the bridge, and under the supervision of the chief mate who was at the boat station. The crew had prepared the port side lifeboat for launching. First of all the boat had been lowered, unmanned, down to two metres above the water line using the winch brake. No irregularities had been ascertained. After this the boat had been heaved in completely. The boat had then been manned by two able seamen and a third nautical officer. The boat's crew had been wearing helmets and life jackets. The safety belts available in the boat had been fastened during lowering and hoisting. The boat had been lowered into the water gently. The releasing hooks had only been released when the boat was in the water. After moving right round the vessel once and testing the lifeboat's own sprinkler system, the boat had been taken to the pick-up position below the davits after about 20 minutes. The boat's crew had secured the releasing hooks and then hooked in the suspension rings of the forward and aft boat runners. The lifeboat had then been hoisted. The boat had been taken in completely and secured in the davits using the lashing. In doing so the boat crew had been supported by three further crew members who were assigned to the boat station. With this the boat drill had been ended and the master had left the bridge.

On heaving in the boat/clearing the gear an irregularity had been ascertained. The third nautical officer had reported this to the chief mate when the boat was back in its stowage position. They both had looked over the problem in the boat. None of the

[2] FSO – Floating Storage and Offloading Unit

crew members present on the boat had been included in the discussions or informed of the nature of the problem. After this the officers had decided to launch the lifeboat again. The other third nautical officer in charge of the watch on the bridge had been notified of the intention. He too had not been informed of the precise reasons. The master had not been informed of the intention.

The boat lashings had been removed again. After this the two officers and one of the able seamen of the 1st manoeuvre had manned the boat. The officers were not wearing life jackets or helmets. It had not been observed whether the persons involved in the boat had fastened their belts. The able seaman had later reported that the I. Officer held the release handle. After the boat had been closed completely, it had been launched again using the centrifugal brake of the winch. The brake had been operated directly at the winch by the boatswain. Both davit arms had swung out to the end position and the boat had been lowered another 20 cm. At this moment first the forward releasing hook had released. The bow of the boat had tipped approx. 15° down and the boat had turned slightly around its longitudinal axis to port. Then the aft releasing hook had released. The boat had turned further and then landed on the water surface on its roof in the bow area. It had remained lying upside down there.

After the crash lifebuoys fixed to ropes had been thrown down to the boat. The nautical officer on watch had sounded a general alarm at 11.20 h and the crew had been informed of the events by an announcement.

One member of the boat's crew had been able to free himself from the boat through the forward window hatch and had emerged after a short period under the boat. A line had been thrown to him that he secured to the boat in order to prevent it drifting away.

After considering various possibilities and the dangers involved for the crew assigned, the master had decided to draw the boat to the area of the crane located midships on the port side using the line. During this operation the master had informed the terminal manager of the occurrence and had requested support from the terminal's stand-by boats approx. 6 nm away. At about 11.45 h the lifeboat had been drawn to the position beneath the crane. While waiting for the auxiliary vessels, the crew member in the water had been recovered on board with the aid of the gangway that was lowered completely. At the same time two other crew members had tried to place a sling around the boat from the passenger basket hanging from the crane. However, when this sling was lifted, it had slipped off the hull of the boat.

At about 12.13 h the first auxiliary vessel, LAMNALCO CORMORANT, had reached the area on the port side of OLIVER JACOB. Shortly after this the mooring boat PUFFIN had joined it. A staff member of the terminal crew had gone into the water from the PUFFIN and had secured two slings on the fastening devices of the slide rails of the lifeboat. On lifting the boat, however, these two had bent up as a result of the weight and the attempt had not succeed. In a further attempt, shackles had been first secured to the releasing hooks by diving. It had then been possible to attach slings to these. This procedure had been successful and at about 13.07 h the crane had lifted the lifeboat onto the work deck of LAMNALCO CORMORANT. The lifeboat

had been turned into its normal position in the course of this operation. It had been discovered that the two persons remaining in the lifeboat were dead. Later the crew had lifted the boat onto the deck of OLIVER JACOB and recovered the dead. The surviving crew member had only sustained minor injuries.

The lifeboat was inspected in the course of the following days by representatives of the vessel operator, staff of the German Embassy in Cameroon and the public authorities of Cameroon. On behalf of the See-BG[3] the Classification Society Germanischer Lloyd dispatched a representative for an inspection. The Federal German Police started investigations.
The Federal Bureau of Maritime Casualty Investigation was notified by the vessel operator immediately after the accident and initiated the steps necessary for the future investigation.

The two dead persons were transferred to Germany and a post mortem examination was conducted by order of the public prosecutor's office. Both men died due to the injury caused by the impact.

4.4 Damages

Neither OLIVER JACOB nor the davits sustained any damages. Nothing is known about environmental pollution.

[3] See-BG – Marine Insurance and Safety Association

5 Investigation

5.1 OLIVER JACOB

As of July 2002 the vessel had been operated by Ernst Jacob GmbH & Co. KG. As of September 2003 it had been owned by SAG Unternehmensbeteiligungs-gesellschaft MT OLIVER JACOB mbH & Co. Tankschiff KG. It had been sailing under the German flag since September 2005.

5.2 Boat's crew

At the time of the accident the boat's crew consisted of three persons. One officer had been on board since December, but had been able to gather experience with this type of lifeboat beforehand on a sister vessel. The other officer had been on board since September. Both were in possession of a valid certificate of proficiency as lifeboat-/rescueboatman. They had been trained for this at German training facilities. The third seaman was a able seaman and had been on the vessel since November.

Due to the crewing, the chief mate was engaged in daytime duty. The III. Nautical Officer was integrated in a 4-8 watch system.

5.3 Launching device

The gravity davits used on OLIVER JACOB allow for launching boats independently of electric drives. The start of lowering and the lowering speed are regulated by a brake integrated in the heaving winch. In cases of emergency the brake is operated via a deflected wire rope from the boat. Normally, this is done via a lever located directly at the winch.
To take the boat back on board, there must be one person on board the vessel. The lifeboat can be hoisted motorised or manually.

At the time of the accident there were three further persons in the direct vicinity of the boat. These were on the one hand the brake operator at the winch, and on the other hand two crew members who held the securing lines of the hoisting blocks.

5.4 Lifeboat

On the instruction of the Federal Bureau of Maritime Casualty Investigation, the port side lifeboat that had sustained the accident remained on board OLIVER JACOB up to the next port. The tanker was intended to discharge in the north of Long Island/USA. When the tanker had reached the roads there, the lifeboat was taken ashore on 16 February 2006 on a barge, placed on a trailer and transported to a closed storage hall on Long Island. A team from the Federal Bureau of Maritime Casualty Investigation observed the landing and then examined the boat. The examination was supported by an expert from the U.S. Coast Guard.

The lifeboat is product of Hyundai Precision & Ind. Co. Ltd., Korea. It is a enclosed combined lifeboat and rescue boat of type HDL 71 CF based pursuant to the investigation on a design by the firm Mulder & Rijke. Messrs. Mulder & Rijke were taken over by the firm Umoe Schat Harding.

The key features of the boat are:

- Type: HDL 71 CF (Totally Enclosed and Fire Protected)
- Classification: Det Norske Veritas, Nr. ULN-98 1001
- Serial number: E-98-32-546
- Capacity: 32 persons
- Length: 7.10 m
- Width: 2.40 m
- Net weight: 2730 kg
- Total weight: 5540 kg
- Engine: Saab Motors A/S, Type L3.139 LB
- Rating: 21.9 kW
- Speed: 6.43 kn
- Material: fibre reinforced plastic (FRP)
- Year built: 1998

Figure 3: Starboard lifeboat of OLIVER JACOB

Due to its intended use as rescue boat, the port boat has a stronger engine and the heaving winch has a higher performance than for the starboard boat. The two boats are built exactly the same in all other points.
The boat is equipped with a surrounding sprinkler system intended to cool the outer plating in the event of fire.

The boat is accessed on the long side via a large hatch folding inwards at the top. A hatch of the same design is installed on the other side. Two further window-like hatches are installed at the forward and aft front of the upper shell. These too open inwards at the top. The heaving hooks can be reached from these apertures. There is a dome with windows on the top side of the upper shell for the boat driver. There is an elevated seat inside the boat in this area. This is also where the engine operating elements are located.

For the period of lowering and hoisting the boat driver like all other occupants should take a seat on a surrounding bench. The places are marked and equipped with a belt system. The system consists of two textile belts guided on the left and right side of the body. The belt guidance starts in the neck area in the wall and runs rather like a rucksack belt cross the shoulders to the seat. From here the belts are placed over stirrups, seated with small pop rivets in the seat area, to the lap of the person. The belts are closed with metal plates that can be interlocked. It is possible to tighten the belts to fit the size of the persons sitting on the bench. The belts should be fastened completely, i.e. should fix the upper part of the body and the hip area.

At the time of the accident the persons were distributed in the boat as follows:
the officers had taken seats at places 6 and 7, the able seaman was sitting on place 21 (see Fig. 5).

The investigators of the BSU ascertained that the deflecting stirrup on the seats of the officers showed similar patterns of damage. The stirrup pointing forward had broken out of the seat material completely. The stirrup pointing aft had come loose at one side at one of the places.
The belts and belt guidance at the seat of the 3rd person showed no signs of damage.

The following further damage was ascertained during the investigation of the lifeboat in the USA (Fig. 4):
- fractures over the entire upper shell (roof) of the lifeboat,
- roof ripped off at the steering stand,
- bending at the frames of the two window hatches in the way of the heaving hooks,
- window flap ripped off at the forward hatch,
- piping system of the outer sprinkler system almost completely ripped off,
- deformation in the inner piping.

Figure 4: Port rescue boat of OLIVER JACOB when landing in USA

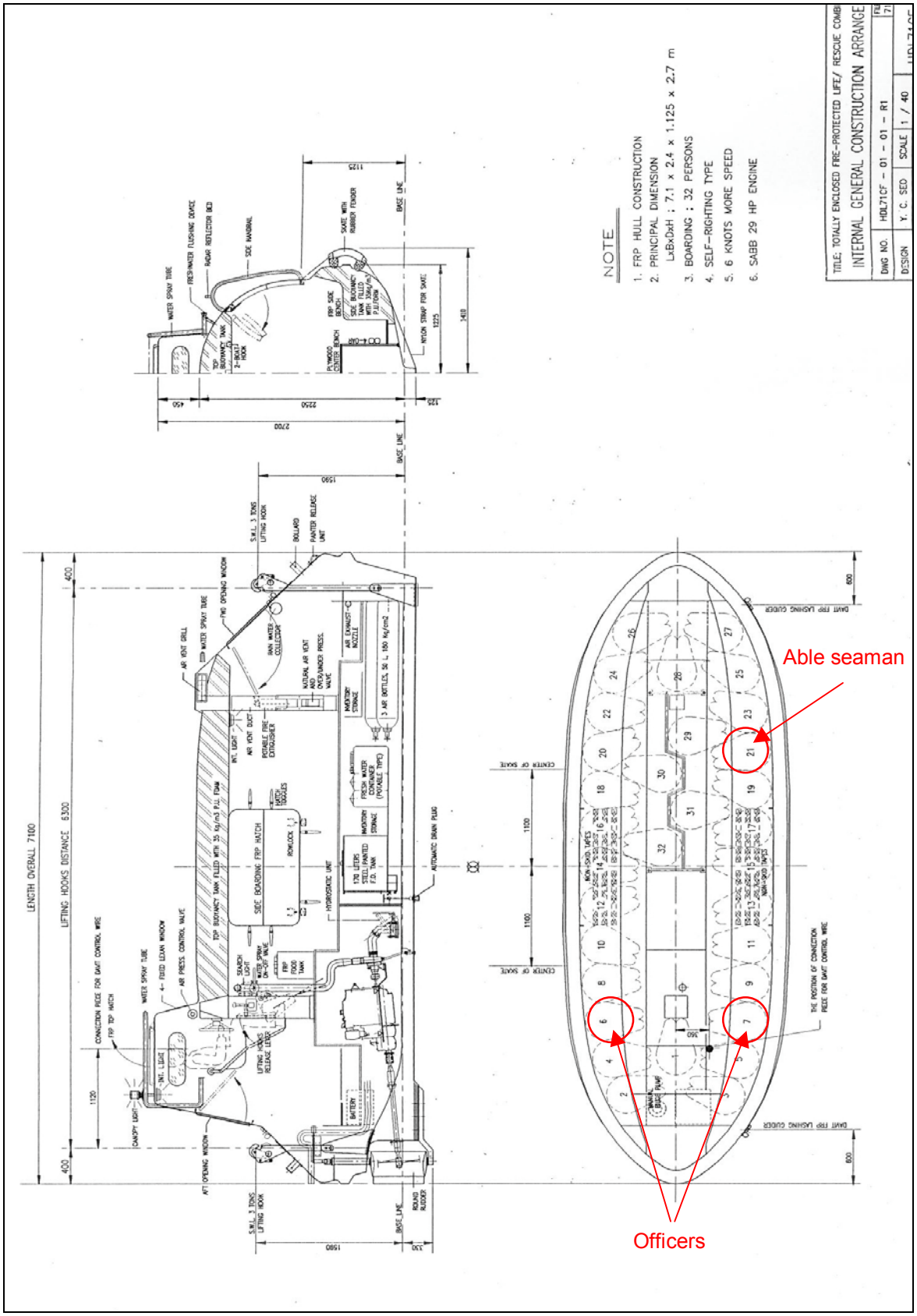

Figure 5: General arrangement plan of the interior of the lifeboat

5.4.1 Release gear

The boat was equipped with a releasing gear from the William Mills (Marine) LTD/UK that could be released centrally. The releasing hooks were of the type Titan TG 354 and had been built in 1998. The maximum load was 3 t per hook.

A centrally operated releasing gear system consists of the following components (Figure 6):

- A releasing hook forward and aft that can be remote-controlled. A suspension ring is inserted in each hook. This ring is in turn secured to a boat runner that is tackled as a double whip. This wire runs over the davit arm and changeovers on a winch.
- A central release unit. This operating part makes it possible to release the two hooks at the same time by means of the connected bowden cables/operating cables[4].
- A hydrostatic unit. This component is subjected to the water pressure when the lifeboat is waterborne. Via a further bowden cable this opens the hydrostatic interlock flap in the central release unit, which is the interlock of the release mechanism for the hooks and then deblocks the release unit. This procedure is called Off-Load-Release, in other words the boat is no longer hanging in the boat runner.
  Certain situations require release when the boat is still hanging completely in the boat runner. In order to override the hydrostatic interlock it is possible to unlatch the flap of the hydrostatic interlock manually by a lever. This makes it possible to release under load, designated as On-Load-Release.

The system on board the port side lifeboat of OLIVER JACOB was in line with the above description.

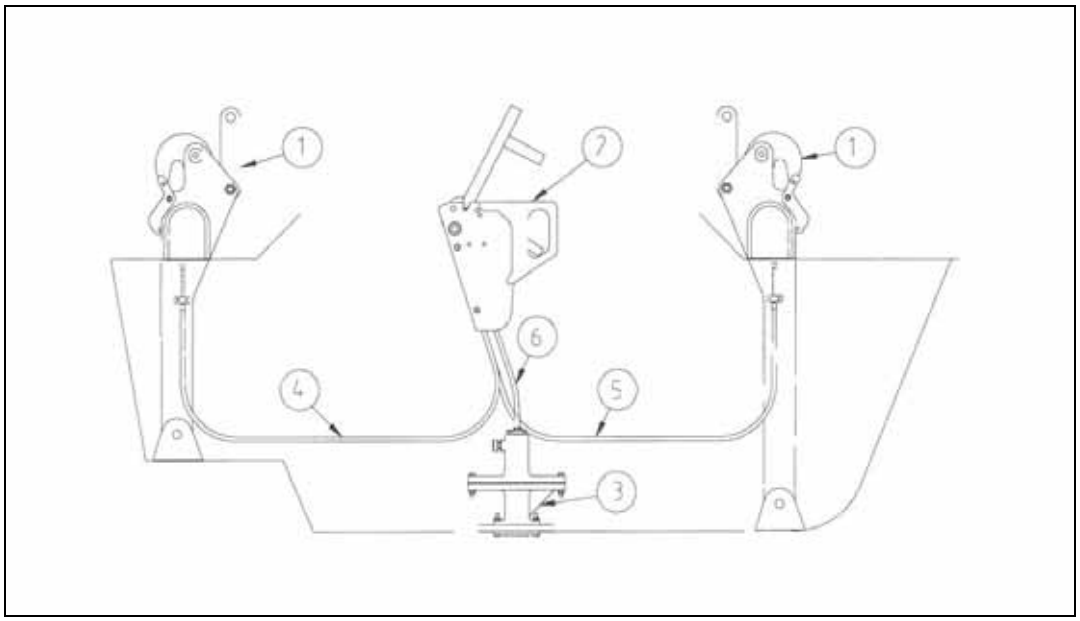

Figure 6: Structure of centrally releasing hook system.
1 – Releasing hook, 2 – release unit, 3 – hydrostatic unit, 4 – aft bowden cable, 5 – forward bowden cable, 6 – bowden cable from the hydrostatic unit to the hydrostatic interlock

[4] bowden cable also referred to as teleflex cable or morse cable

5.4.2 Release unit

The release unit is installed between two vertical foundation plates (cf. figures 7 to 9). The bowden cables of the releasing hooks and the hydrostatic unit are connected to the release unit. The bowden cables of the releasing hooks are each secured to a segment disc (operating quadrant). The release handle is fitted on the axle between the two operating quadrants. Two leading pins on the release handle are engaged in stand-by condition in grooves (safety slots) in the foundation plates. The leading pins at the same time block the operating quadrants.
The release handle is doubly secured against unintentional release. The following steps are necessary to operate the release handle:

- First of all a safety pin inserted from the exterior must be removed. The safety pin holds the release handle in the engaged position. The safety pin itself is secured against unintentional dropping out by spring-loaded balls at the end of the pin. A central operating head on the pin serves to loosen the ball tension and thus makes it possible to draw out the safety pin.
- As a second step the release handle spring-loaded on an internal tube must be drawn upwards. This causes the leading pins to leave the safety slots in the foundation plates and at the same time frees the operating quadrants.

On release the driving pins at the release handle move the operating quadrants and the bowden cables are drawn in the direction of the release unit. The operating quadrants can only be turned when they are no longer blocked by the hydrostatic interlock flap. The hydrostatic interlock is thus the third securing mechanism in the release unit (Figures 7, 8).

In order to be able to unlock the hydrostatic interlock flap in on-load operation it is provided with a handle projecting outwards (hydrostatic locking lever). This handle is marked yellow and protected by a cover box. Glass panes in the box and colour markings on the frame provide information on the condition of the hydrostatic interlock (see Figures 7, 9). The cover is held in position by two snap locks. If these are released, the cover folds down and allows access to manual unlocking of the hydrostatic interlock.

The release unit on the port side lifeboat of OLIVER JACOB was mounted on the port side of the conning position.

Judging by the photos made available, the Federal Bureau of Maritime Casualty Investigation assumes that at the time of the examination in the USA the release unit was in the situation in which it was found after the accident (Figure 10). During the examination it was ascertained that the release handle was in the angle position "secured", but was not engaged in the safety slots (grooves) in the foundation plates. Engaging of the leading pins on the release handle was prevented by the aft operating quadrant lying beneath it. It was also ascertained that the safety pin was only inserted through the forward foundation plate. It was not possible to introduce it completely. This could only have been done if the release handle had been fully engaged (Figures 10, 11).
The cover box over the hydrostatic locking lever was no longer in its actual position. It had been destroyed during the accident so that it is not possible to make any validated statement on whether it was open or not.

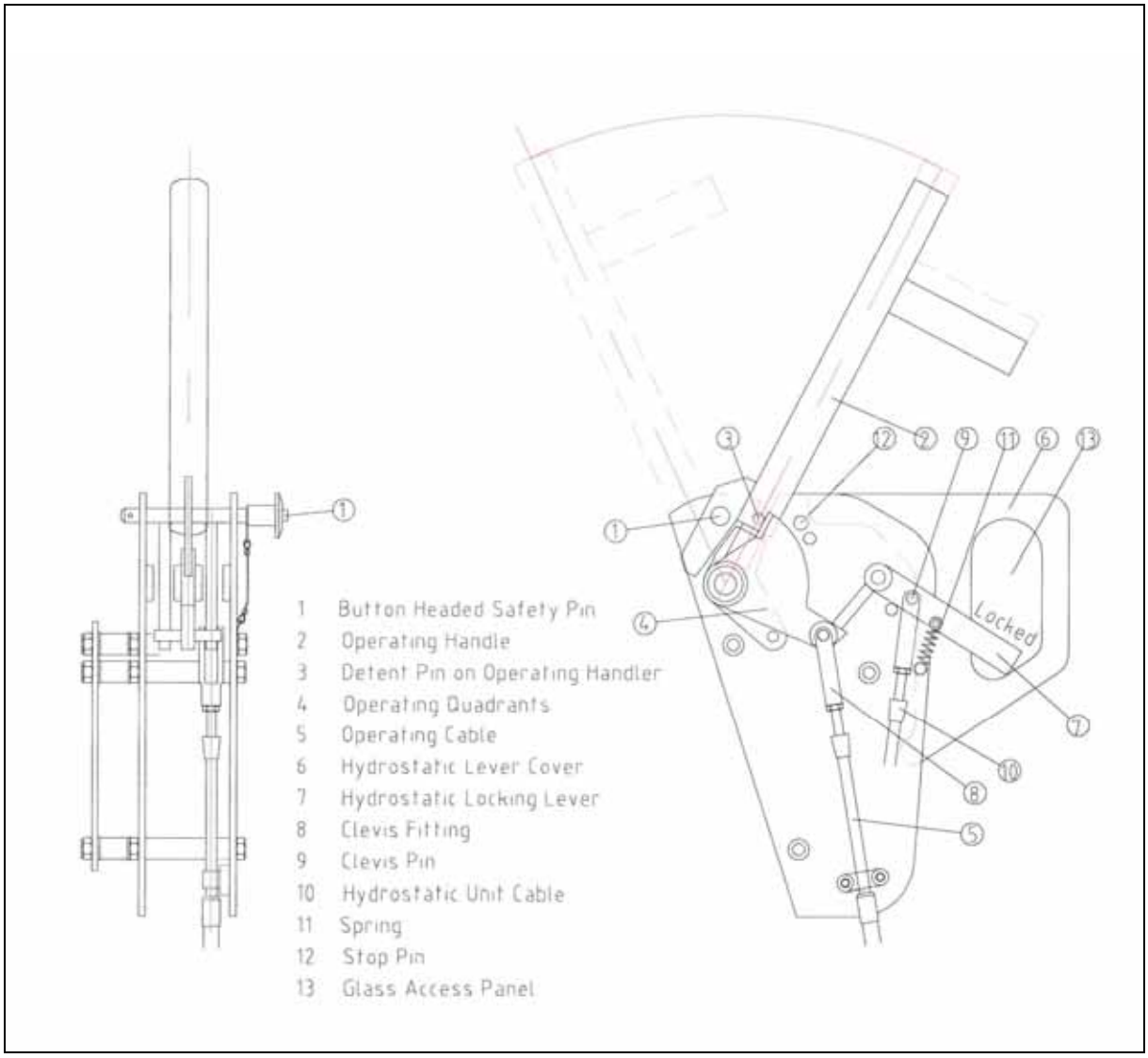

Figure 7: Release unit in schematic representation

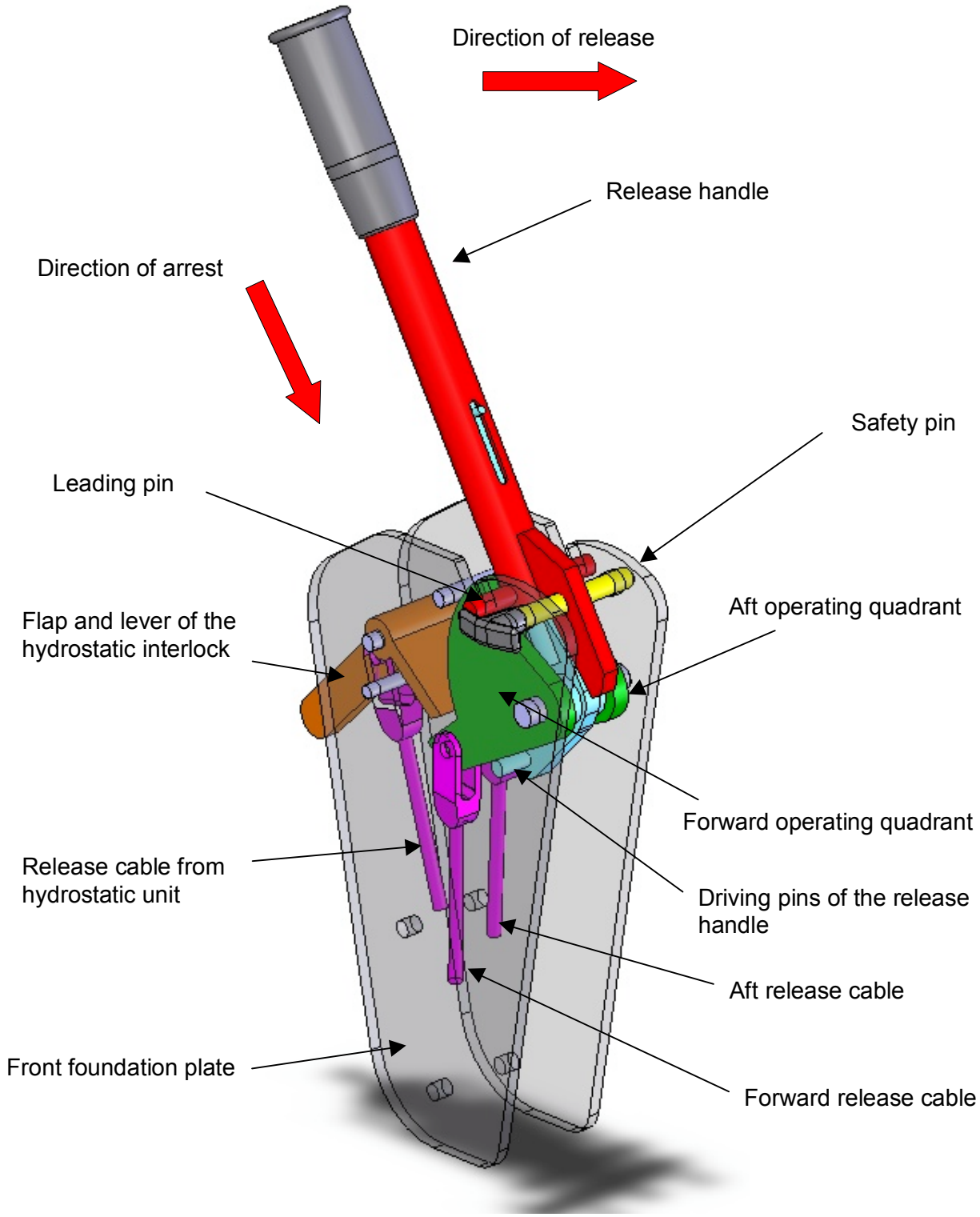

Figure 8: Release unit in three-dimensional representation

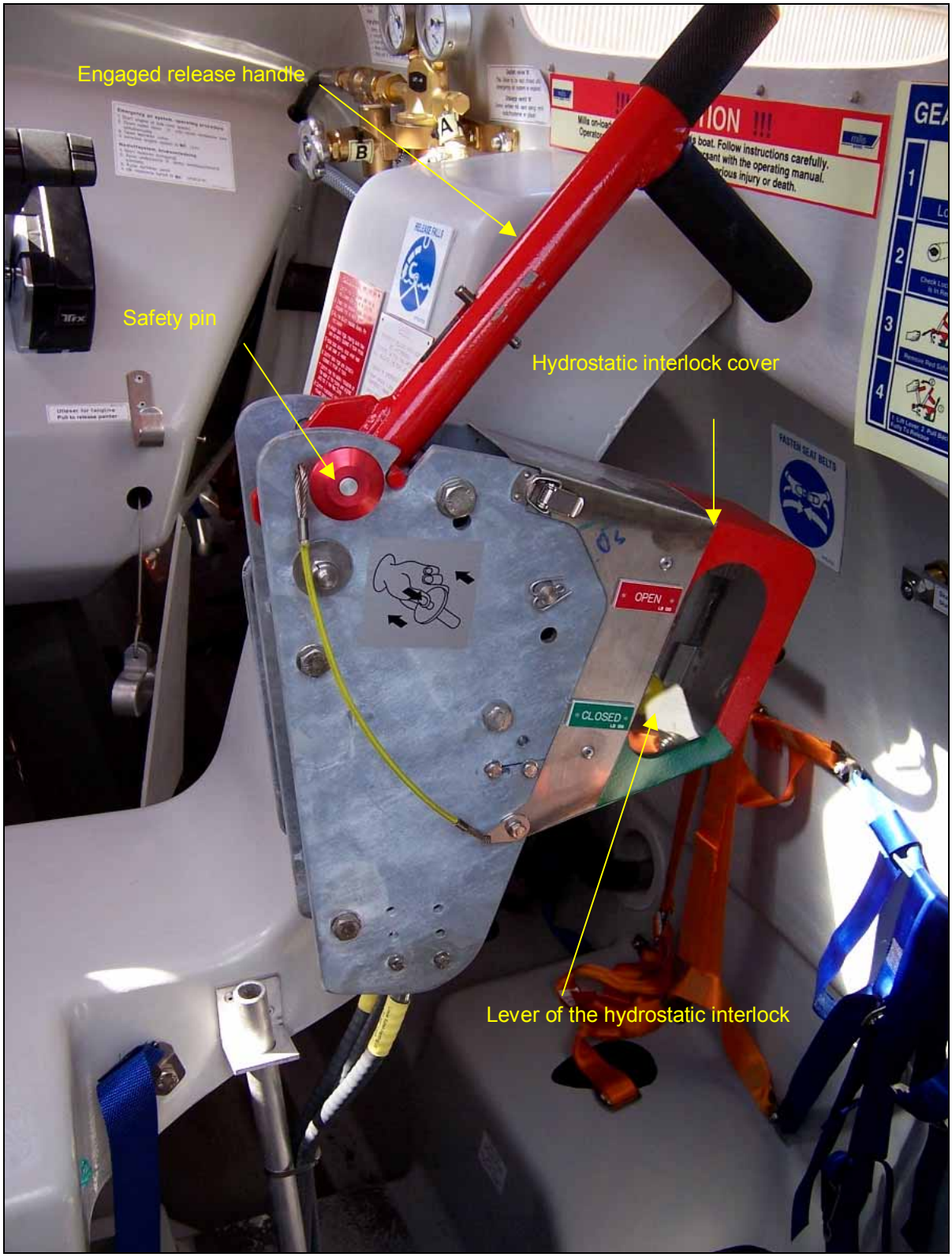

Figure 9: Release unit in completely secured position, i.e. release handle engaged, safety pin introduced, hydrostatic interlock engaged - here yellow lever behind glass disc in "Closed“ position; (other vessel)

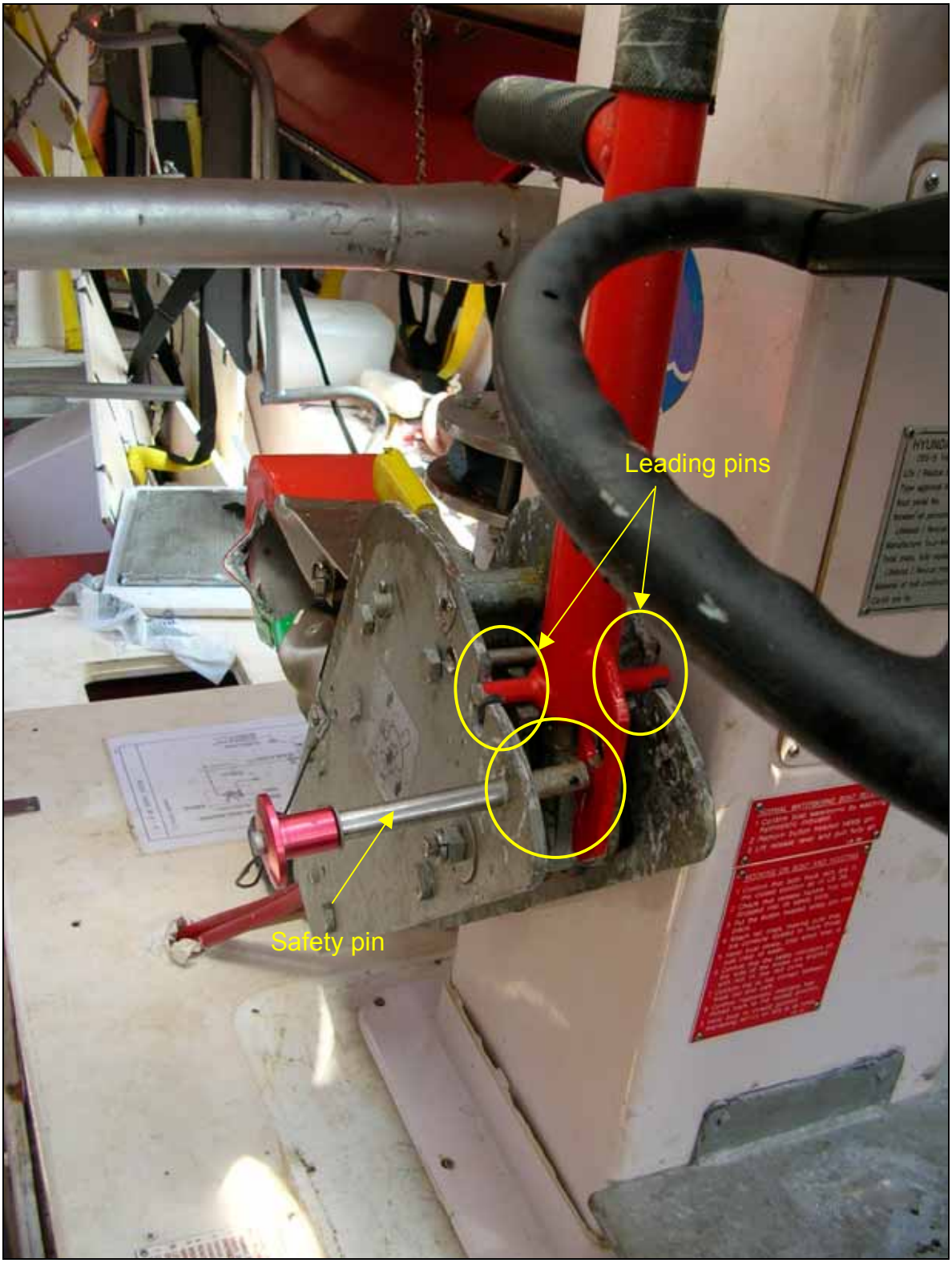

Figure 10: Release unit after the accident; leading pins not in the safety slots in the foundation plates, safety pin not inserted

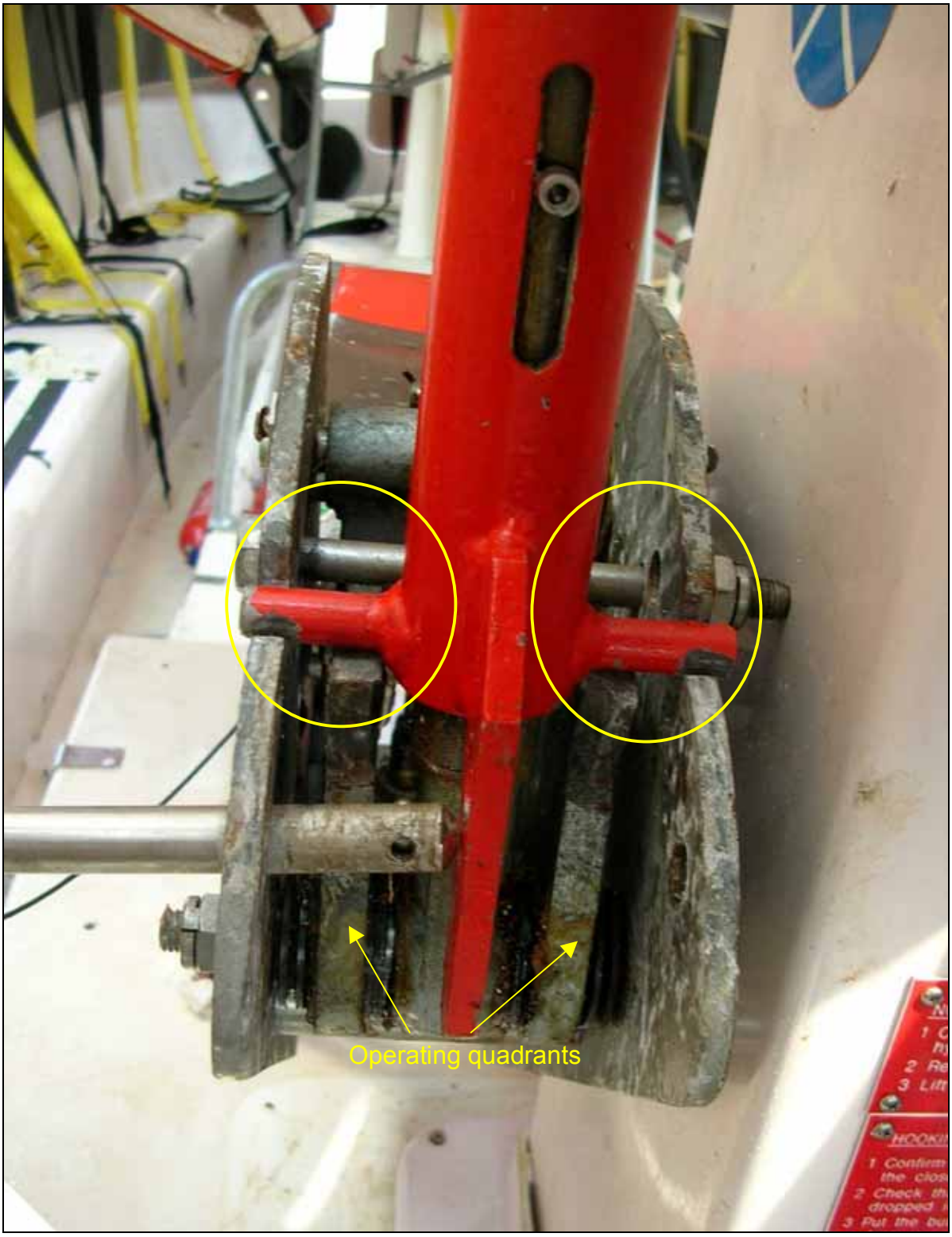

Figure 11: Release unit after the accident; the leading pins resting on the operating quadrants

During the examination on Long Island first experiments on the releasing characteristics of the releasing hooks and the release unit were carried out. In doing so the mentioned elements were only moved with physical strength. To what extent the hydrostatic interlock thereby secured the system could not be noticed by reason of the covered construction. However, it was ascertained that the hooks did not release before the hydrostatic interlock was manually unlocked.

5.4.3 Releasing hook

The releasing hook consists of two vertical foundation plates and the actual hook between them. The foundation plates of the releasing hook are tapered strongly downwards and are fixed to the keel of the lifeboat. The hook is constructed and placed in bearings between the foundation plates in such a way that in off-load condition the opening of the hook points downwards. Under load the hook would turn around the bearing axis and the opening would point upwards. In order to control this turn, the tail of the hook rests against half the area of a bolt, here a half-round bolt, that is mounted through the foundation plates at right angle and lies parallel with the bearing axis. The bolt represents a kind of cam (cam release pin). In its secured position the cam release pin prevents the hook tail from swinging through under load (Figure 12). The cam release pin is in turn connected with the bowden cable to the release unit via an externally mounted arm (operating lever). The mounting point lies beneath a cover.
On the side opposite the bowden cable there is a hand-lever (reset lever/cocking lever) on the cam release pin. This lever is used to turn the cam release pin back into the holding position after a release operation. The cam and the hook tail should then rest flat against each other. In the manuals this is described as face-to-face or flat-to-flat-contact. In order to visualise this position there are stroke marks on the outer sides of the releasing hook and coloured sectors (red and white) on the foundation plate/the cover (Figure 13). The mark on the release bolt must stand in the white area when it rests flat-to-flat.
When the cam release pin is turned into the holding position via the reset lever, the bowden cable pulls the corresponding operating quadrant in the release unit back into the starting position at the same time. Only after both releasing hooks are secured, in conjunction with turning the operating quadrants back in the release unit, is it possible to engage the release handle in its completely secured position.

To hoist the boat, after the releasing hook is secured, the suspension ring of the boat runner is hooked in manually in the hook. A moving flap in front of the hook opening is intended to prevent the ring from slipping out unintentionally in the off-load condition.

Each releasing hook of this type is furthermore provided with an auxiliary suspension. This allows the boat to be hung-off independently, e.g. for maintenance purposes (Figure 13). For this an appropriate hanging system, two release pennants made of wire (Hanging-Off Pendant or Hanging-Off Pennant) is supplied with the boat. The hanging-off pendants are secured to the auxiliary suspensions of the releasing hooks and secured at the attachments points on the davits provided for this purpose. After this it is possible to relief the load on the releasing hooks and to work on the releasing hook system of the lifeboat safely.

In the manual of the boat manufacturer available on board, a drawing displays the use of the recovery strops for rescue boats too. This consists of two further wires that can be inserted as an extension of the boat runners when the boat is hoisted. The reason for using such strops is the saver handling during unfavourable sea conditions and a reduced danger for the operators of the releasing hooks caused by large swinging metal blocks.

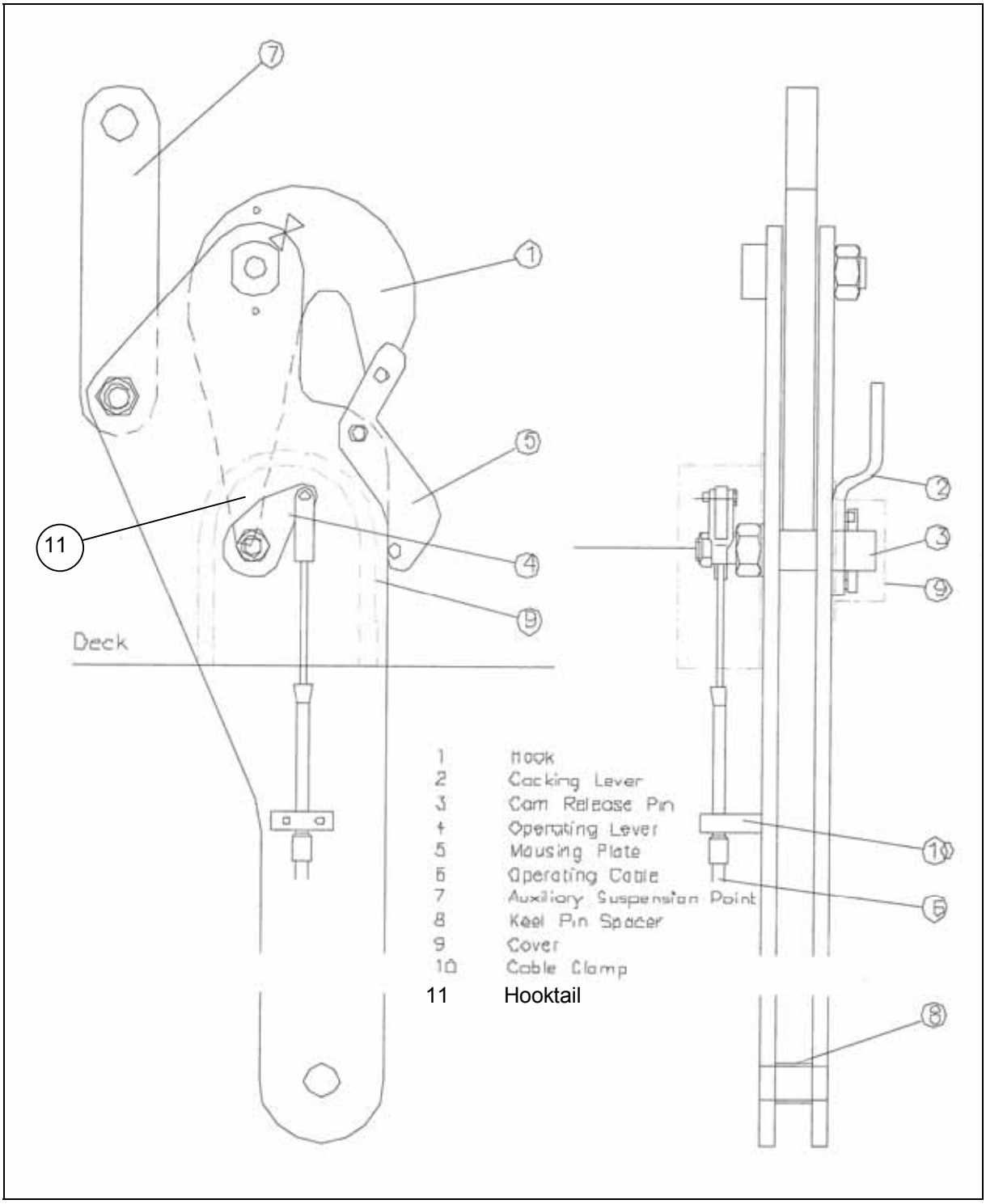

Figure 12: Structure of a releasing hook

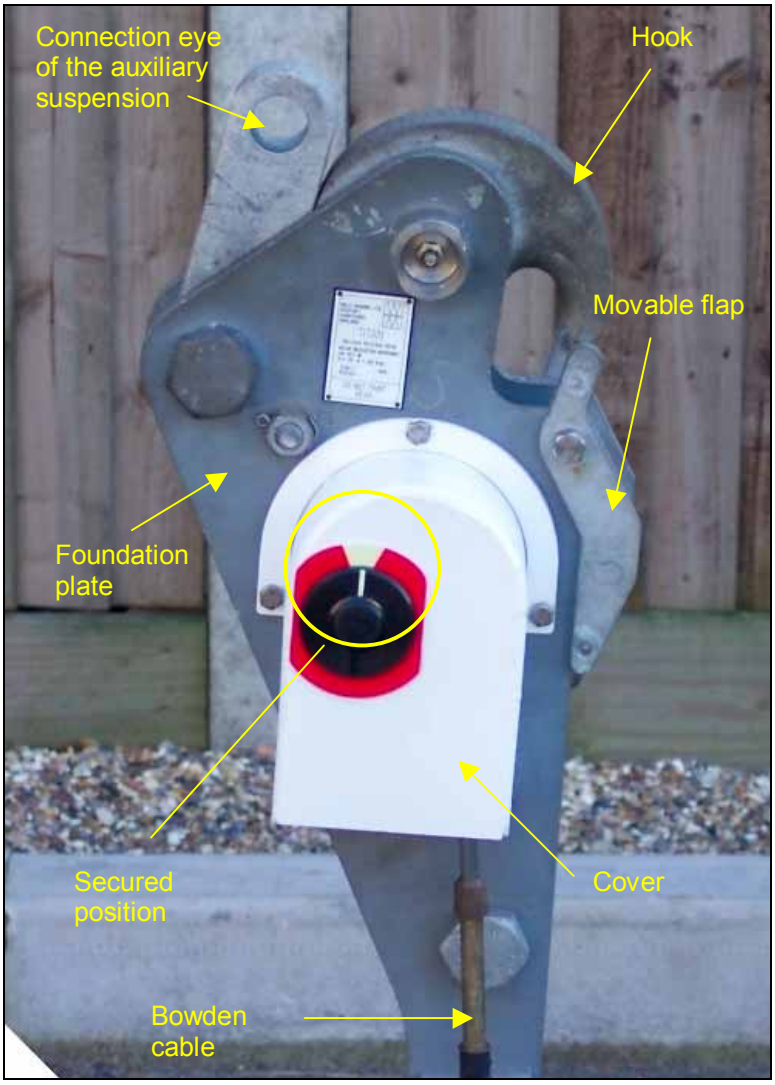

Figure 13: View of a releasing hook with the secured position marked

The hooks and foundation plates of the releasing hooks of OLIVER JACOB were made of galvanised steel. They showed signs of corrosion. The cover of the bowden cable at the aft releasing hook had evidently been exchanged, as it was less corroded. The foundation plates had a coloured coat of paint on the outer sides[5]. The marks displaying the holding position, in other words flat-to-flat contact of hook tail and cam and hence the secured position of the releasing hook, was only present at the aft releasing hook and there only on one side (Figures 14 and 15).

The forward hook tail appeared to have been subjected to wear at the contact place with the bolt. An irregular gap was ascertained between the hook and the bolt.

[5] As specified in the manufacturer‘s manual colouring the releasing hooks is not permissible. According to Umoe Schat-Harding this state should have been noticed on service.

Figure 14: Forward releasing hook, port side, with red and white sector lacking on the cover

Figure 15: Aft releasing hook, starboard side, with renewed cover

The staff member of the US Coast who attended the examination pointed out two significant points on centrally releasing hook systems:

1. **Backlash in the bowden cable**[6]
   This backlash is generated on the one hand due to strain, thus due to the different extension or pressing of the materials of the bowden cable core and the bowden cable coat on the impact of tensile forces or compressive forces during the operation. On the other hand it is generated as a result of the backlash between core and liner in the bowden cable. In bowden cables resting in bends this backlash causes that with tensile force the core rest in the inside of the bend and with compressive force the core rest at the outside of the bend. The backlash is altogether depending on the length of the bowden cable, the number of bends and their radii as well as on the force exerted in relation to seize/diameter of the bowden cable.

During the examination it was attempted to determine the „backlash“ within the system releasing hook-bowden cable-release unit. Different, manually exerted forces on the reset lever at the cam release pin and backlash resulting from this were laid on a simple graphometer. The motion of the operating lever was used as reference point. Thereby „SP“ means slight pressure (force) and served for the deletion of the slack in the system, that means building a basic force. In the state „WP“ – with pressure – with all physical strength the reset lever was moved in the direction, which was intended to release the system. „O“ made clear the point, at which the cam release pin was turned that far, that it released the hook. The hook as well was only manually loaded.

The figures 16 and 17 indicate, that the angles for „SP“ with approx. 53° on the forward hook and approx. 55° on the aft hook, as well as for „0“ with 120° on the forward hook and 118° at the aft hook were almost the same. However, the angles for „WP“ strongly deviated on the forward and aft releasing hook. On the aft hook the angle for „WP“ was the same as the angle for „SP“. On the forward hook the angle for „WP“ was about 81°. Therewith it was possible to move the cam release pin at the forward releasing hook by the exertion of a relatively low force ⅓ in the direction of the release.

[6] http://www.teleflexmorse.com/documents/Cable&App.pdf

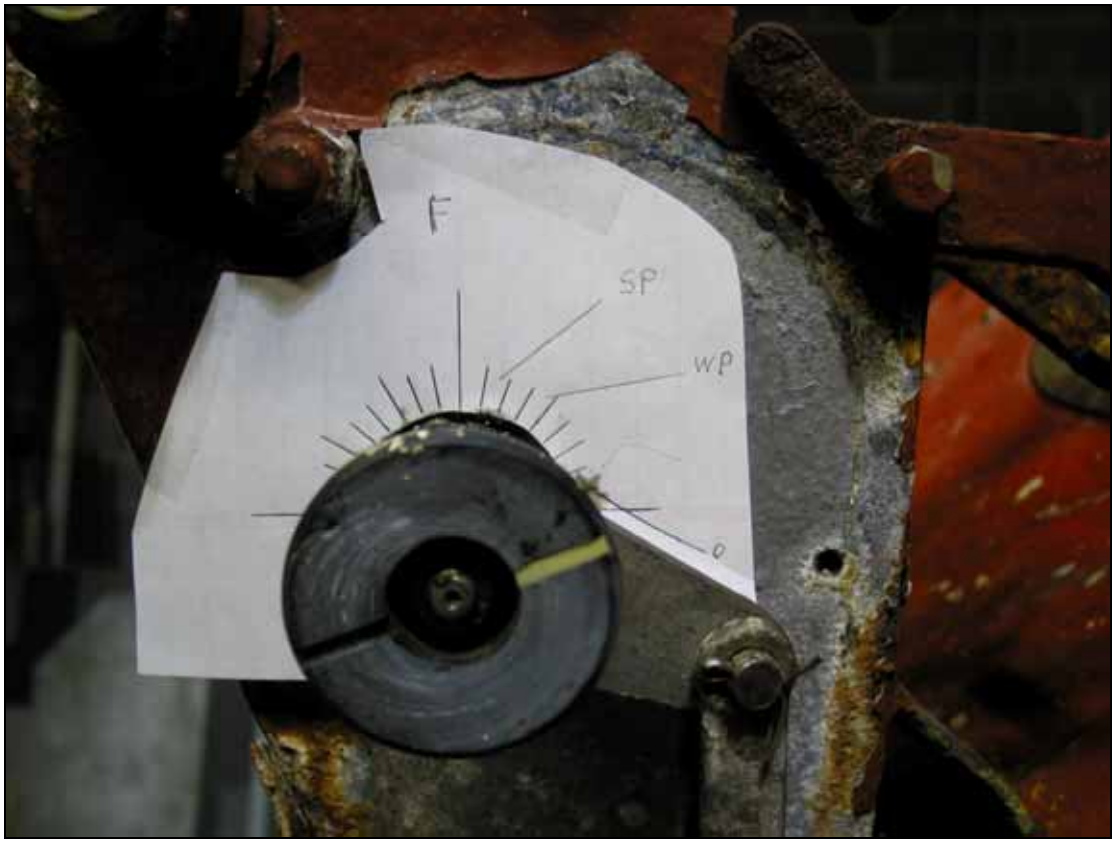

Figure 16: Forward releasing hook with graphometer and recorded angles

Figure 17: Aft releasing hook with graphometer and recorded angles

2. Inherent Locking Stability

This point results from an examination of the Canadian National Research Council – Institute for Ocean Technology of 2005. The institute examined two different releasing hooks, an older system and a new system. They carried out three different tests:

- Test 1 – On-Load-Release Test – was aimed at determining if the releasing hook worked as required, should serve for the ascertainment of the release angle under load, should define the force necessary for turning the cam release pin;
- Test 2 – statical load test – served for the examination of the forces exerted on the cam release pin and the bowden cable on unintentional setting of different opening angles
- Test 3 – Failure test – should assess the properties of the releasing hook on failures such as rupture of the bowden cable.

At the examination of the older releasing hook, tested and approved for a working load of 5 t the researcher ascertain the following:

- On-Load-Release Test:
  - The moment necessary for turning the cam release pin was almost zero up to an angle of 20° and then rose exponential up to the release angel of 70° to 425 Nm.
  - At the same time the mass acting on the bowden cable was measured. This also increased from 20° exponential onwards up to approx. 650 kg.
  - With the exertion of the load on the cam release pin this turned from the 0° position about 3° to 4°.
- Statical load test:
  - In doing so the moments were measured by the opening angles of the cam release pin from 0° up to 60°, which acted in the release direction of the cam release pin, thus emanating from the cam release pin.
  - At a turning angle of 2° a moment of about 57 Nm occurred. This moment decreased up to an angle of 10° on 10 Nm and then rose almost linear. At 50° the turning moment was about 68 Nm. At 60° it independently released.
- Failure test:
  - The cam release pin was set to 0°, then the force acted on it was increased from 0 kN on. Before the force of 10 kN (1000kg) was reached, the hook released.

Summarising it was ascertained that the bowden cable of the older construction was affected by very high compressive forces. For this reason there is a big danger of damage. On the damage of the bowden cable the older releasing hook was not able to structurally balance this failure. It released immediately. The releasing hook had not inherent locking stability. The older releasing hook was similar to the releasing hook on the OLIVER JACOB.

5.4.4 Signage

There were plastic plates on the forward and aft hatches explaining the handling of the releasing hooks (plate LB 34i) (Figure 18). The reset of the releasing hooks was explained on them in text form.

There were further plates at the conning position:

- The sign designated as LB 25 (Figure 19) described the normal release of the mechanism in the condition boat in the water.
- The sign LB 17i explained the fundamental reset of the releasing hooks, the hooking in of the rings of the boat runners, the reset of the release unit and the recovery of the boat with the associated controls (Figure 19).
- A further sign (LB 07) described the On-Load-Release (Figure 20).

There were no drawings or pictographs illustrating the necessary actions on the releasing hook system in the boat[7]. According to Umoe Schat-Harding this should have been identified at a service.
Except for one plate with the circuit diagram of the auxiliary system for starting the engine with compressed air, none of the other actions such as fastening safety belts in the boat or starting the engine were explained by pictographs. All the signs were written in English.

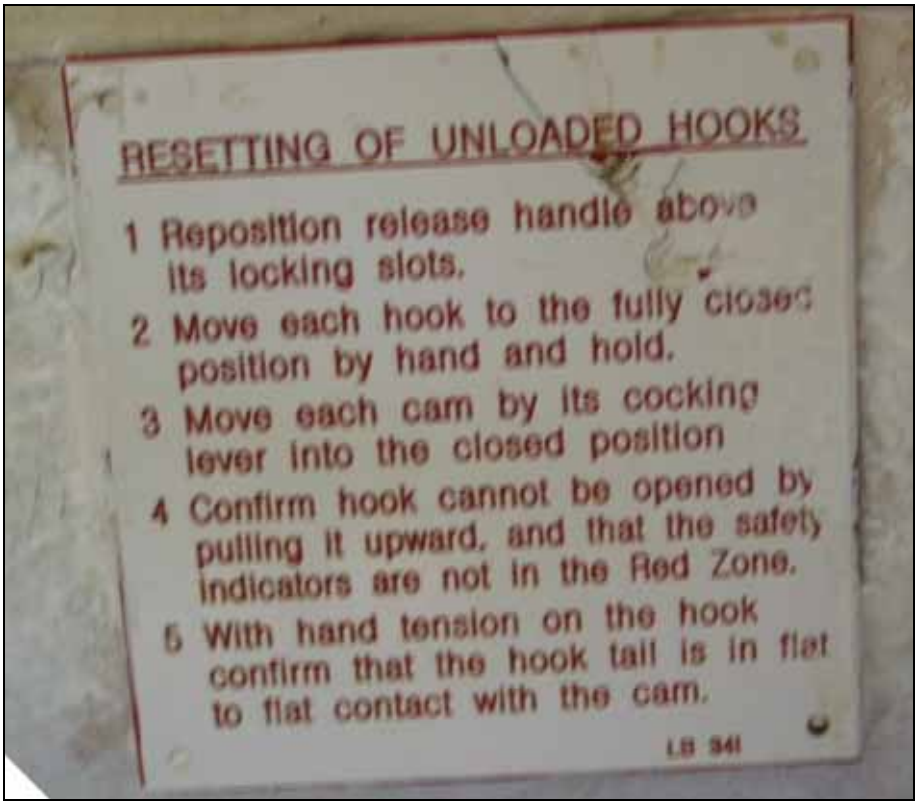

Figure 18: Description of the handling of the releasing hooks, plate LB 34i

[7] e.g. see the poster in appendix No. 9 in annex

Figure 19: Plates LB 25 and LB 17i

Figure 20: Plate LB 07, On-Load-Release

5.5 Investigation on board OLIVER JACOB

5.5.1 Questioning of witnesses

On 18 February 2006 the Federal Bureau of Maritime Casualty Investigation inspected the OLIVER JACOB in the roads of the Conoco Oil Terminal/Long Island. Thereby, amongst others, the crew members who had been in the immediate vicinity of the lifeboat were interviewed. One of the persons interviewed was a member of the boat crew at the previous boat manoeuvre.
The survivor of the boat crash could not be interviewed.

One of the persons interviewed stated that before hoisting in the boat again a member of the boat crew had noticed the safety pin at the release unit projecting 1 cm. He had informed the officer and had been reassured that everything was all right.
Actually the safety pin had such a clearance when completely inserted and secured.

During the interview one crew member gave the opinion that all lifeboats and release systems would be similar.

There were neither Hanging-Off Pendants nor recovery strops on board OLIVER JACOB.

5.5.2 Manuals

The master of OLIVER JACOB handed over two manuals. The first manual contains the installation, maintenance and spare parts of the davits, the winch and the wire ropes used. The manual had been issued by Dongwoo Machinery & Engineering CO., LTD.

The first cover sheets of the second manual indicate the boat manufacturer HYUNDAI-MULDER & RIJKE and HYUNDAI PRECISION & IND. CO., LTD.
The manual starts with the fundamental description of an enclosed, fire-protected lifeboat/rescue boat with two general arrangement plans of the boat for inside and outside. The simple overview of a centrally releasing hook system (similar to Figure 6) is followed by an inventory list of the boat covering 35 points. Most of the manual deals with the engine and its individual parts, including a spare parts list. The other major part then comprises an "Operation and Maintenance Manual" for the boat. It starts with the description of the start/stop operation of the engine, the steering, and then describes on one page the release and reset of the hook system. After this a further inventory list of the boat is provided, this time comprising 39 points. Point 39 states the "Lifting hook instruction manual book" with a note, " Lifting hook maker standard". The following maintenance plan covers three pages. Some of the maintenance points also relate to the boat and the releasing hook system. The book closes with instructions for repairing damage to the FRP hull of the boat.

Neither a manual corresponding to point 39 above nor any other manual that described the structure of the releasing hooks, or any evaluation of possible wear of them, the function and maintenance of the system or possible dangers was on board OLIVER JACOB.

Nor was there any manual on board explaining the handling of the release system[8].

The vessel command was unable to present any maintenance log.

5.5.3 Starboard boat

During the visit to OLIVER JACOB the remaining boat was inspected. It was ascertained that the manual lever of the hydrostatic interlock on the release unit was not clearly in the green area and thus did not clearly indicate the secured condition (Figure 21).

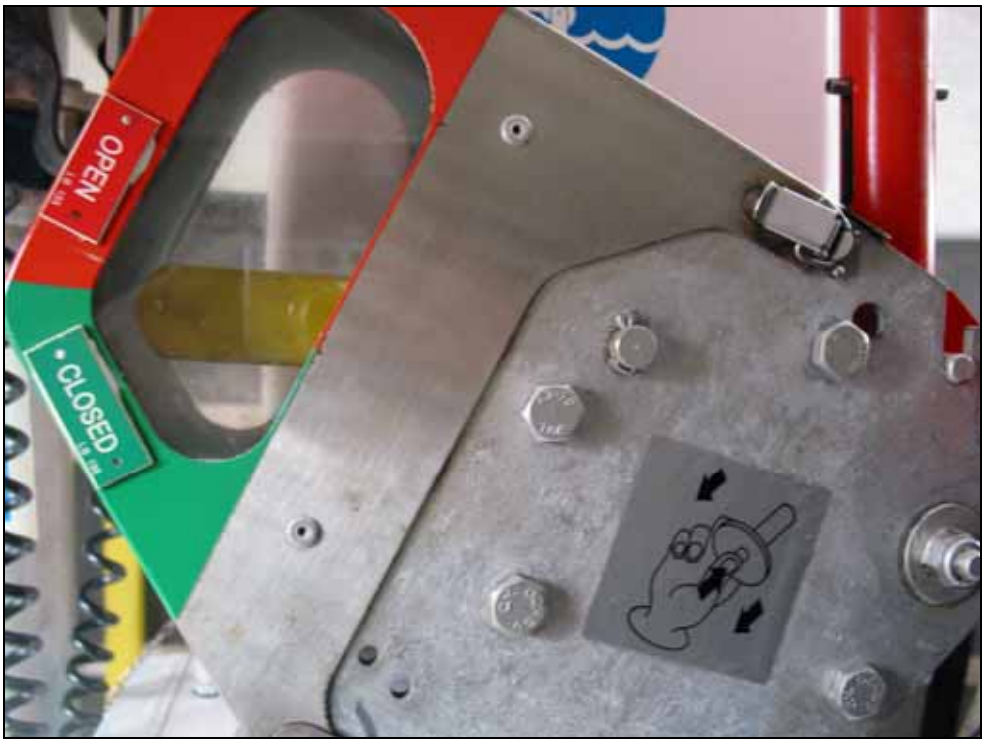

Figure 21: Release unit of the starboard boat of OLIVER JACOB; here cover of the lever of the hydrostatic interlock with marks and yellow manual lever of the hydrostatic interlock

5.6 Boat manoeuvre and maintenance

The vessel operator made the ship's reports in accordance with ISM-Code[9] available to the Federal Bureau of Maritime Casualty Investigation. It is evident from the documents that 16 abandon ship drills and one "person over board" manoeuvre were carried out in the year 2005.
A further exercise was carried out under the supervision of the U.S. Coast Guard on 11 November 2005. The Federal Bureau of Maritime Casualty Investigation was not advised of any details of the extent of this exercise.

The boats, the engines, the equipment and the davits were maintained and checked weekly or monthly in accordance with the maintenance plan contained in the ISM

[8] In the comment on the draft investigation report Hyundai Lifeboats Co., Ltd. advised the BSU that a manual of the manufacturer of the releasing hook system William Mills (Marine) had been provided when the boat had been delivered.
[9] ISM-Code – International Management Code for the Safe Operation of Ships and for Pollution Prevention

manual. This maintenance plan did not contain any features according to which certain wear on the hooks could have been assessed.

5.7 Investigation in Germany

To prepare the investigation of the centrally releasing gear, the Federal Bureau of Maritime Casualty Investigation team dismounted the following parts from lifeboat and shipped them to Germany:

- the forward and aft hooks,
- the release unit,
- the hydrostatic unit
- all the bowden cables.

The bowden cables were only detached at the hooks and the hydrostatic unit, but not on the release unit.

The Federal Bureau of Maritime Casualty Investigation commissioned the Expert Dipl.-Ing. Jan Hatecke to examine the components. Mr. Hatecke worked together with the Institute for Material Science and Welding Technology of the University for Applied Sciences, Hamburg (IWS).

At the IWS the releasing hooks and release unit were secured to a foundation frame (Figure 22). The experimental rig also contained the hydrostatic unit and the bowden cables supplied. Facilities for introducing tensile forces into the releasing hooks, measuring the forces introduced and measuring movement angles were also integrated. By subjecting the hydrostatic unit to different water columns, it was possible to simulate On-Load- and Off-Load Release.

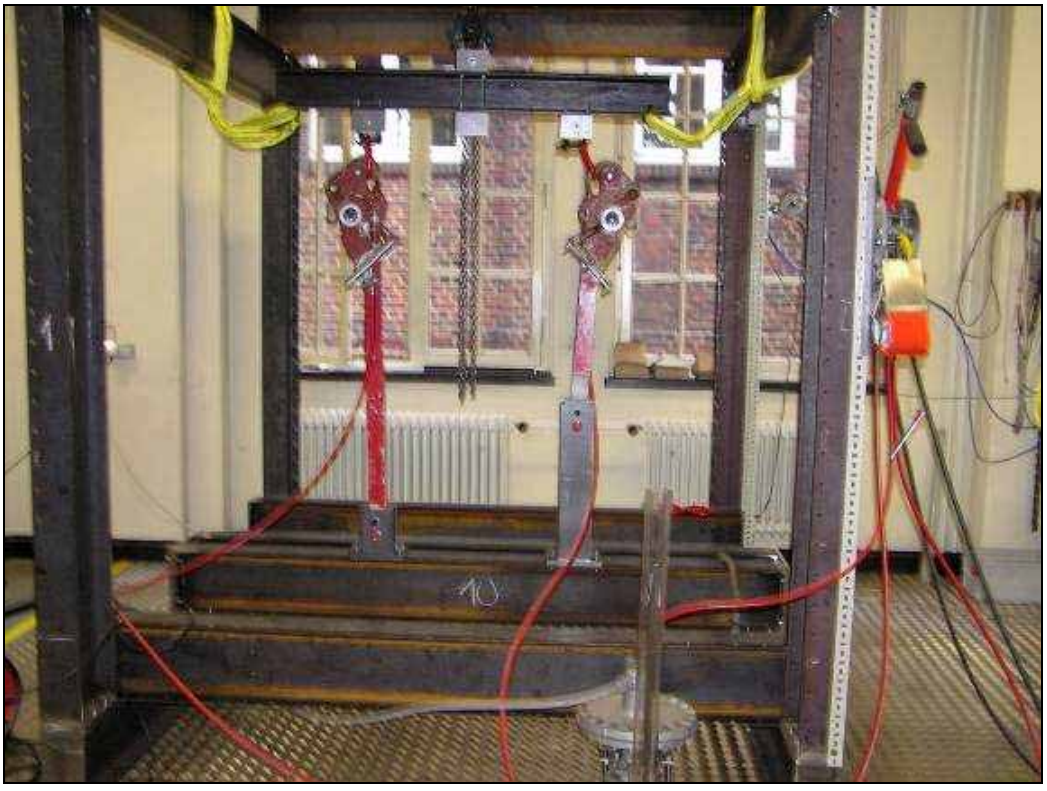

Figure 22: Experimental rig at the Institute for Material Science and Welding Technology

5.7.1 Examination of the centrally releasing hook system

Representatives of the vessel operator, the present manufacturer, the classification society, the See-BG and the BSU attended the experiments to release the releasing gear at the Institute.

In the experiments the releasing hooks were subjected to load individually and as a pair. The examination was to clarify the following questions:

- To what extent was the system secured at the time of the accident?
- Was unintended release possible?
- If yes, what forces led to unintended release of the hooks?

For some of the tests the experimental setup was in the condition in which it had been found after the accident. In this regard see also Section 5.4.2 .

The investigators could not detect any signs of damage at the hydrostatic interlock and the bowden cables and no restriction of their function. Also the observers did not make any remarks concerning this matter during the experiments.
The inscription of the bowden cables did not contain any information on the manufacturer.

During the investigation it was ascertained that the system could not been secured by the hydrostatic interlock. This was caused by the aft operating quadrant that was not turned back completely and that had already prevented complete engaging of the release handle.

The release handle located in the "secured" angle position only had the effect of apparent safeguarding. Because of the internal spring, it was resting on the operating quadrants with some pressure and thus impeded their movability.

The forces leading to release of the forward hook were lying in the range of 39.00 kN with the release handle resting on the operating quadrant (see “A” in figure 23) and at 16.51 kN when the release handle was lifted; at the aft hook the forces were 36.55 kN and 55.6 kN[10] in the contact position of the lever and 26.85 kN with the lever raised.

[10] Two different results for the same experimental setup

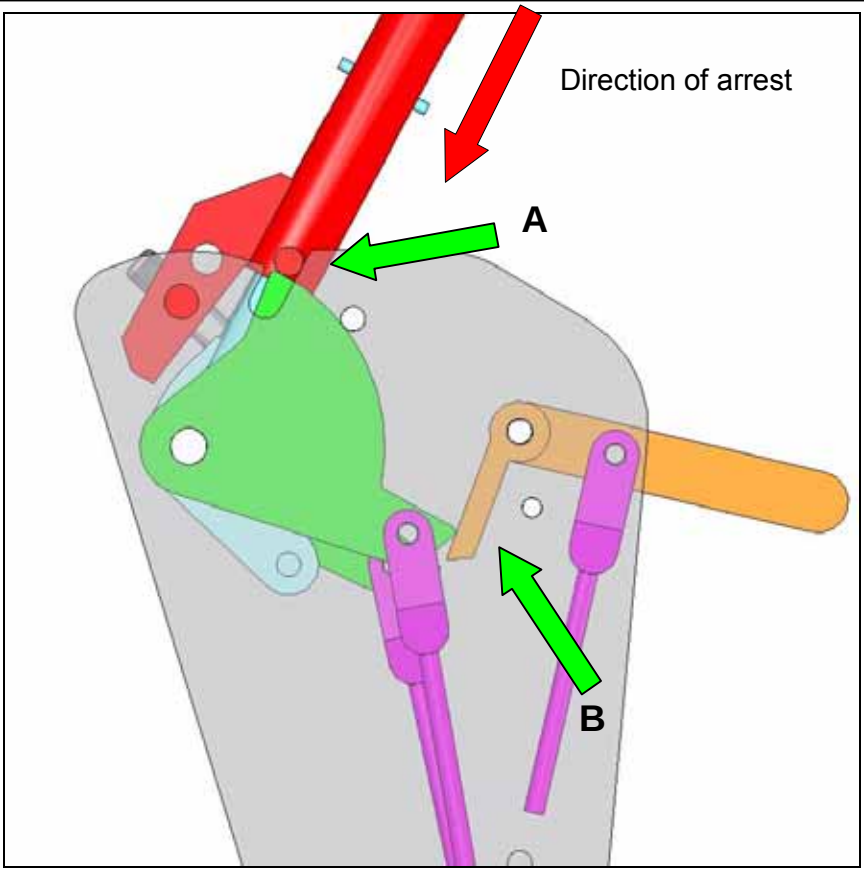

Figure 23: Release unit

A: The side leading pin of the release handle rests on the aft operating quadrant.
B: The hydrostatic interlock can not secure the two operating quadrants as it rests against the aft operating quadrant and against the aft release cable respectively.

For details of the concrete test procedure, reference is made to the expert opinion by the expert Dipl.-Ing. Jan Hatecke enclosed with this report.

To summarise it can be ascertained that the experiments conducted with the condition of the releasing gear existing at the time of the accident reproduced the self-detaching of the releasing hooks. The malfunction of the aft operating quadrant and hence blocking of all safeguards occurred again consistently.
In the course of the examination the expert then adjusted the position of the bowden cable to the aft operating quadrant in order to achieve complete turning back of the aft operating quadrant. For this the fastening of the bowden cable on the foundation plate was offset downwards by using the second mounting point which laid 22,5 mm below and the hitherto fully turned in forked head was turned out by 4.73 mm (Figure 24). This modification led to the desired result. The aft operating quadrant turned back completely. The release handle could be engaged completely, the hydrostatic interlock secured the system and the safety pin could be inserted as specified. In the subsequent experiment simulating the load of a completely manned boat with all safeguards in place, the load was held.

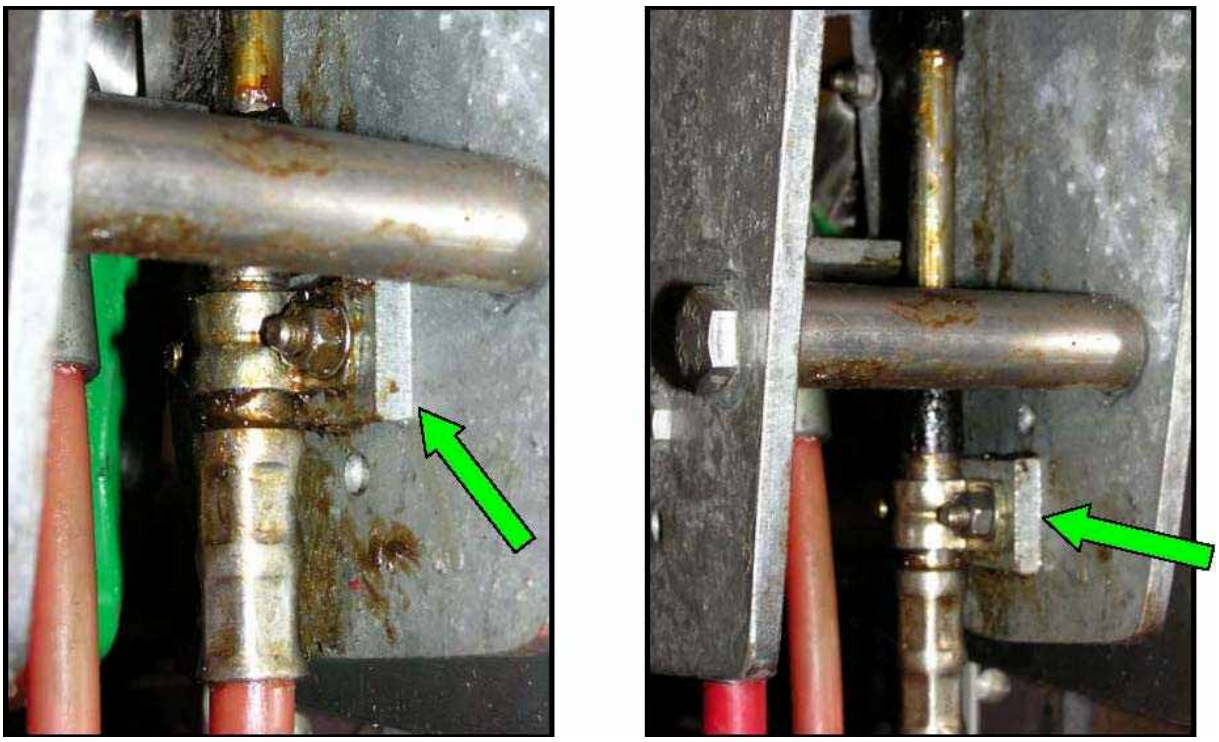

Figure 24: Mounting point of the bowden cable at the foundation plate; original left, modified right

In the final experiment a boat manned with three persons (approx. 3.3 t) was simulated. The release handle was in its fully secured position. It was additionally fixed by the safety pin. The hydrostatic interlock was kept open. With a force of 16.51 kN per hook exerted, the forward releasing hook released.

5.7.2 Examination of the hooks and bolts

The expert of the BSU confirmed the fundamental dimensional accuracy of the hooks[11]. In cooperation with the Institute for Material Science and Welding Technology the expert ascertained that the steels specified by William Mills for hooks and bolts had been used (see Expert Opinion). The hooks were hot galvanised as provided for in the design. An examination of the rolling direction of the hooks was refrained from, as the results were not considered to be relevant.

The subject of the examination by the Institute was to ascertain the distance between hook and bolt and the rounding at the hook tail at the point of contact with the cam release pin. The following values were measured:

- Distance forward hook - release bolt 1.9 – 2.0 mm
- Distance aft hook - release bolt 1.8 – 1.9 mm
- Rounding of forward hook 1.75 – 3.0 mm
- Rounding of aft hook 1.75 – 2.25 mm

It was possible to see strong wear of the edge of the releasing hook in contact with the cam release pin with the naked eye (Figure 25). The hook was affected by corrosion.

[11] In the comment on the draft investigation report Umoe Schat-Harding draws attention to the fact that the investigation did not contain any information on an excessive use of the rescue boat since the hooks were replaced in Singapore. Hence the manufacturer, taking into account the fact, that the radius at the hook tail and the distance hook-release cam pin were that big, draws the conclusion, that the drawing and the actual hook did in fact deviate from each other.

No material reductions or corrosion could be ascertained on the cam release pin.

Figure 25: View of the forward hook; asymmetrical rounding, wear edges, strong corrosion

The following marks or designations were ascertained on the objects during the inspections:

- The forward and aft releasing hook were provided with a riveted metal plate on one outer side of the foundation plates in each case. This plate showed that the manufacturer of the overall releasing hook was William Mills (Marine) LTD. The plate contained further details of the test year (1998) and the maximum load (3 t/hook). On none of the two releasing hook foundation plates were stamps of any classification society, test institute or manufacturer to be found.
- Only the forward hook was marked on one side area with the stamp

  BTC 8279-4
  WLL 3 T
  TL 7,5 or TL 172,5 T (not clear)
  FEB 04

  The aft hook showed no markings.
- The bolts were each marked on the head end with the number 688309.

5.8 Technical acceptance tests and inspections of boat and release system

The following sequence of acceptance tests and inspections is shown from the copies of documents presented to the Federal Bureau of Maritime Casualty Investigation :

- **overall vessel:**

- *Record of Approved Cargo Ship Safety Equipment*
  for the vessel with the IMO Number 9175078 on the occasion of commissioning of the vessel in 1999.

- *Survey Report Testing of Launching Appliances and On-Load Release Gear*
  for OLIVER JACOB in connection with the class renewal, issued by Det Norske Veritas (DNV) on 22 April 2004.

- *Report of Periodical Surveys*
  issued by DNV on 09 February 2005.

- **the boat:**

- *Type Approval Certificate*
  for a lifeboat of type HDL71CF
  manufactured by Hyundai Precision Ind.Co, LTD in Ulsan/Korea
  issued by DNV on 31 July 1998, valid until 31 July 2002.

- *Inspection Report* and *Delivery Test* for the boat with Serial Number: E-98-32-546
  in the presence of a DNV surveyor, carried out and issued on 23 October 1998.

- *Release Test* with the boats of OLIVER JACOB
  by Sembawang Shipyard Pte Ltd, Singapore, on the occasion of the class renewal, in the presence of a crew member and a surveyor on 22 April 2004.

- *Initial and Periodical Survey of Accident Prevention and Safety Equipment*
  Survey on the occasion of changing to German flag by the See-BG and Germanischer Lloyd (GL) in Long Beach/USA on 19 September 2005.

- **the releasing hooks:**

- *Certificate of Type Approval*
  for a Titan 3.0 t hook
  manufactured by William Mills (Marine) Ltd
  by Lloyds Register (LR) on behalf of the Marine Safety Agency (MSA)
  dated 18 November 1997, valid until 17 November 2002.

- *Lifeboat Release System Certificate of Service*
  for the OLIVER JACOB
  by Technofibre (S) Pte Ltd in Singapore, Test Number 2423 (port side boat),
  of April 2004.
  During this service the following parts were exchanged:

- the membrane of the hydrostatic unit,
- the hooks of both releasing hooks.

The hooks had been tested prior to installation. The test number 8279-04 was found on one of the hooks:

Certificate of Test and Examination
of the hook BTC 8279-01 to **8279-04**
by Bridge Testing Center (Pte) LTD in Singapore
on 03 February 2004

A system of the type of the accident boat received an EC Type Examination (Module B) Certificate for a "3 t Off-Load/On-Load centrally operated simultaneous hook release system using two falls – Type: "Titan TG 354"", issued by Lloyd's Register on behalf of the MSA on 26 November 2003.

During the examination enquiries were made with Umoe Schat-Harding Limited to ascertain to what extent Messrs. Technofibre were authorised to conduct services on lifeboats equipped with a release system from William Mills (Marine). They replied that the staff of Technofibre had been authorised to do this by the former owner of William Mills (Marine), the firm Didsbury Engineering. The permit had expired for the staff of Technofibre at the latest in May 2002. Consequently there was no longer any authorisation for Technofibre to perform service work. Furthermore, Technofibre had not at any time been authorised to manufacture spare parts itself.
Umoe Schat-Harding further notified that the parts installed by Technofibre in April 2004 had not been original parts. This was substantiated by the lack of stamps/unusual stamps.

6 Analysis

6.1 Launching device

The launching device of the port side boat was not the subject of further investigations, as there were no indications of any malfunction of the davits or the winch being the cause of the accident.

6.2 Lifeboat

Although the boat was not designed for landing upside down, the structure of the upper shell remained largely intact after the crash from a height of approx. 15 m and thus offered sufficient room for survival almost throughout the entire area of the boat.
After immersion the boat remained completely capsized and floating in the water. According to the International Life-Saving Appliance (LSA) Code[12] Point 4.6.3.2 "*The stability of the lifeboat shall be such that it is inherently or automatically self-righting when loaded with its full or a partial complement of persons and equipment and all entrances and openings are closed watertight and the persons are secured with safety belts.*" The boat was no longer closed watertight as the forward hatch was ripped off on impact and the roof in the area of the steering stand broke open over a large area. The Federal Bureau of Maritime Casualty Investigation did not investigate to what extent an undamaged boat of this type would have uprighted again.
After completion of the investigation by the Federal Bureau of Maritime Casualty Investigation the boat was repaired in a special workshop in the USA.

6.2.1 Releasing hook

Both hooks showed signs of strong wear at the contact point hook tail/cam release pin (see also Figure 25). The investigation by the Federal Bureau of Maritime Casualty Investigation was unable to clarify the cause for the wear.
In the maintenance manual from William Mills (Marine) which was not on board, excessive wear has to be assumed when the radius of the rounding is more than 1 mm. The radii measured during the investigation at 1.75 - 3 mm at the forward hook and 1.75 - 2.25 mm at the aft hook were well above this figure.

The maintenance manual also describes the allowed distance between the hook tail and release bolt. According to the manufacturer the distance may not be more than 1.8 mm. Values of 1.9 - 2.0 mm were measured at the forward hook and of 1.8 - 1.9 mm at the aft hook.

[12] LSA – Life Saving Appliance

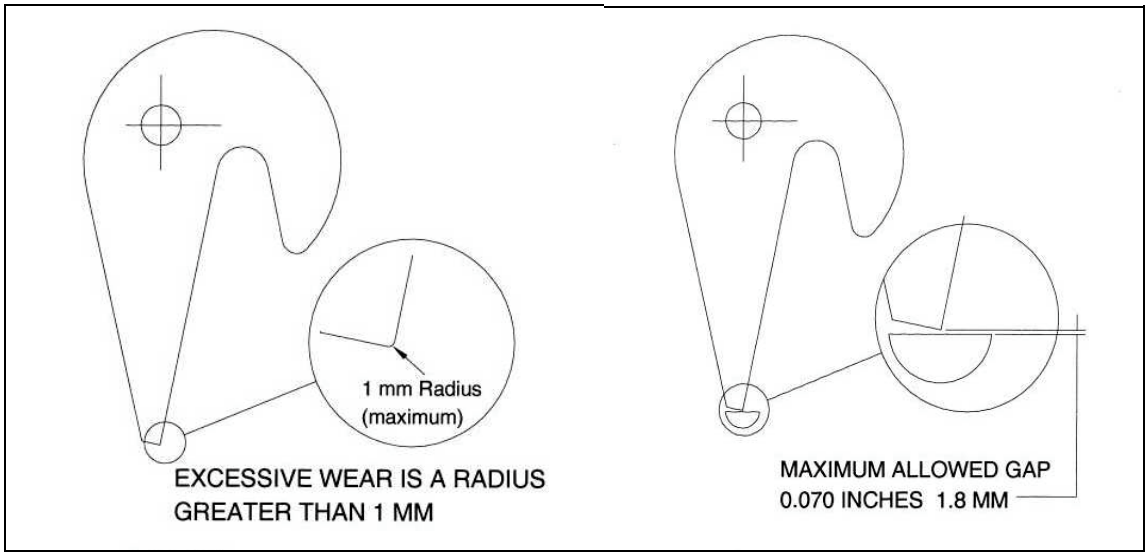

Figure 26: Tolerances at the hook according to William Mill's manual

Therewith the hooks were excessively worn at a crucial position and should have been replaced (Figure 26).

The wearing of the hooks had a crucial influence on the accident. As a result of the wear at the hook tail there was a shift in the point at which force is exerted on the cam release pin. This resulted in a torque on the bolt that, on the one hand, led to the release bolt being able to turn so far that it released the hook. And on the other hand transferred the force to the release unit via the bowden cables and thus caused turning of the operating quadrants (Figure 27).

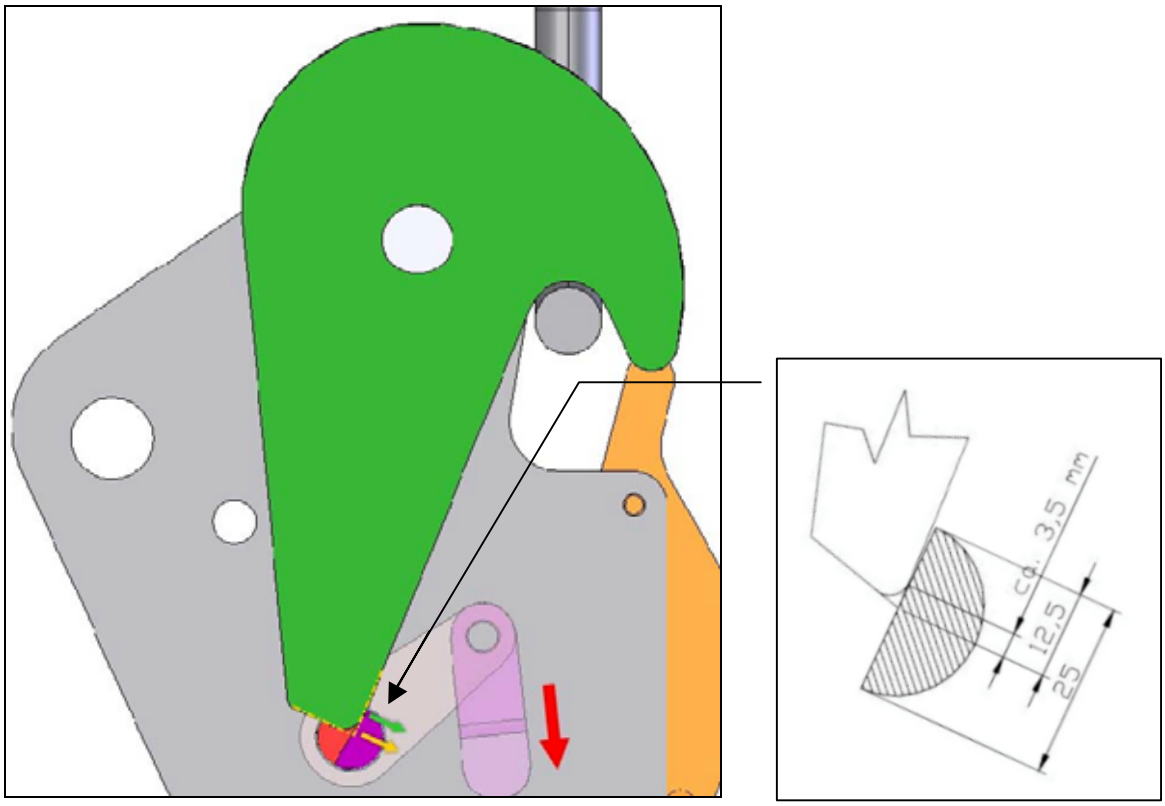

Figure 27: Presentation of the leverarm and the torque on the release bolt

The increase of the radius due to wear could only have been ascertained by the ship's crew with difficulty. The distance between the hook tail and release bolt could, however, have easily been ascertained with a simple feeler gauge. The basic procedure is described in the manual that was not on board.

After two years in use both hooks showed signs of strong corrosion. The hot galvanising had not provided sufficient protection against this. It is questionable whether hot galvanising is expedient at a place subject to such loads as the contact area between the hook tail and the release bolt. It would be advisable to use higher-grade stainless steels here.

The research of the Canadian Institute for Ocean Technology pertaining to the releasing characteristics of releasing hooks was not reflected in the investigation of the BSU, since the present releasing hook system required another approach. Nevertheless the results achieved by the Canadian research are worth noting. On the one hand they show, that due to construction big forces can also be exerted on releasing hooks not worn out. These forces have a negative impact on the bowden cables. On the other hand they reveal that different construction methods lead to stable respectively instable releasing hooks.

The backlash of the bowden cables was not object of the examinations for the expert opinion on behalf of the BSU. This was, inter alia, due to the fact, that the manufacturer of the bowden cables was not known and therefore no documents concerning the bowden cables could be procured. Thus comparable original data were not available. The simple experiments (fig. 5.4.3) carried out already showed an influence.
The photos of the release unit in the rescue boat taken after the accident support the course of the accident depicted in the BSU-report and the experiments conducted in the laboratory confirm this assumption. However, the statement of one of the crew members has to be noted. This crew member has reportedly seen the safety pin in its required position. In this case the forward releasing hook on the OLIVER JACOB could have released by reason of the backlash in the bowden cable in connection with the wear at the hook tail.

6.2.2 Release unit

During the expert examination it was ascertained that the fastening of the bowden cable to the aft operating quadrant was wrongly mounted. Only after it had been converted, sound function was possible i.e. the aft operating quadrant turned back completely. This meant that complete operability of all securing elements on the release unit was restored. In so far the wrong mounting of the bowden cable was causative for the accident.
The Federal Bureau of Maritime Casualty Investigation was unable to reconstruct whether the installation of the bowden cable at the wrong mounting point occurred during the yard period in Singapore and the associated works on the releasing hook system.

The release handle that was simply resting on the operating quadrants did not represent any genuine safeguard. Admittedly the forces necessary to release the releasing hooks with the release handle lying on the quadrants were relatively high

during the experiments, but the values determined do not allow any statement to be made on the forces occurring when a lifeboat is actually launched. Here load peaks occur due to accelerations and vibrations. The values obtained with the release handle raised were thus more informative. In one of the tests the forward hook released at a load of 16.51 kN. This was equivalent to the load on the forward hook of a fully equipped boat in a resting state and manned with three persons.

The release of the aft releasing hook that occurred with the lifeboat of OLIVER JACOB could also be re-enacted in a test. With the release handle raised, the participants observed release at an acting force of 26.85 kN. This corresponded to a lower load than that of the complete boat described above, if this was only carried by the aft hook.

Even after conversion of the aft bowden cable in the release unit, the securing of the system by complete engaging of the release handle was not by itself sufficient to prevent the forward hook from releasing at 16.51 kN. Two conclusions can be drawn from this. The rotating forces acting as a result of the worn forward hook on the release bolt were high. The clearance of the components in the release unit was sufficient to turn the release bolt so far that it released the hook. This test was admittedly not relevant for the crash of the lifeboat. However, it shows that in practice after lifting the hydrostatic interlock when trying to carry out an On-Load-Release with the boat, the forward hook would probably have been released and the boat would thus have crashed.

Consequently the wear of the hooks and the wrongly mounted bowden cable were causative for the accident.

The Federal Bureau of Maritime Casualty Investigation was not able to clarify whether a problem with securing the release unit had already occurred during the only complete launching of the port side boat in June 2005.

6.2.3 Signage

The plates present in the boat contained all the essential points for carrying out On-Load or Off-Load Release. The recovery of the boat was also sufficiently described. Due to the lack of marks on the releasing hooks (see Figures 14 and 15) the description and necessary work steps could only be brought into line with difficulty. For instance, plate LB 17i contained the following text under Point 6: "*Confirm that the safety indicators on the side of the hooks are aligned and not in the red zone."*
In the opinion of the Federal Bureau of Maritime Casualty Investigation pictographs would have distinctly improved the understanding of necessary actions, technical settings and dangers. The operation manual provided by William Mills (Marine) as of 1999 for this releasing hook contains an "Instruction Poster" that would have provided a good basis for such pictographs (cf. footnote 5 page 27).

6.3 Manuals and inspections of boat and release system

On the occasion of the commissioning of the vessel the boat had been surveyed and accepted by the classification society Det Norske Veritas (DNV) in accordance with the valid rules. The manuals available on board (see Section 5.5.2) were evidently considered to fulfil the *Instructions for on-board maintenance* required by SOLAS

Chapter III Rule 36. In fact, however the descriptions of the releasing hook system contained therein were not suitable for maintaining safe operation, as they did not describe the existing system in the necessary depth and did not allow assessment of wear phenomena because the tolerances to be maintained were not mentioned.
If the inventory of the boat had contained the "Lifting hook instruction manual book" listed under Point 39 and if this had corresponded with the "Maintenance Manual" and "Operational Manual" of Messrs. William Mills (Marine) LTD from the year 1997, the necessary information would have been accessible to the ship's crew.

In the year 2004 the vessel underwent its first class renewal after commissioning. On this occasion the tests of the launching devices and the lifeboat On-Load-Release gear test were carried out in accordance with SOLAS Chapter III Rule 20 Point 11.1.2, 11.1.3 and 11.2.3. The survey report issued by a DNV surveyor represents a kind of test list and includes the following points:

- "Operational and maintenance routines of the above checked and found in order?"
- "Lifeboat lowered to just clear of water and On-Load-Release gear tested?"
- "Foundations, blocks, falls release gear hooks, tie-bands, links and shackles inspected after test?"

All test points were answered with "Yes".

The test report does not contain any explicit requirement of a check of manuals for maintenance and operation of the release gear.

The test report contains three questions relating to the "On-Load-Release Gear":

- "Before the above tests, have the release gears been overhauled in connection with testing? → Yes"
- "By whom which competent person/company? → Technofibre"
- "Said personnel are authorised by the manufacturer of the release gear system? → Yes"

As determined under Section 5.8, at the time of the class renewal Technofibre was no longer authorised by the manufacturer. It was no longer possible to ascertain to what extent the surveyor of DNV checked any authorisation. The question as to why the surveyor did not notice that only one of the hooks was stamped and moreover did not comply with the William Mills' standard also remains unclarified.

Even if Technofibre was no longer authorised by the manufacturer at the time of class survey, the service staff should have checked the manuals concerning the releasing hook system on board. This was evidently not done. It also remains unclear how the surveyor of the classification society assessed the condition of the releasing hooks without the tolerances and maximum distances that are only available in the William Mills maintenance manual.

During the survey by Germanischer Lloyd on behalf of the See-BG on the occasion of changing flag on 19 September 2005 the safety equipment was inspected. The documents "Initial and Periodical Survey of Accident Prevention and Safety Equipment and of Measures to Protect the Marine Environment" and "Periodical Survey of Accident Prevention and Ship Safety Installations and Equipment" issued

at that time do not contain any express finding on the availibility of manuals for maintenance and operation of the release gear.

The manuals available on board did, in many points, not meet the requirements in Rule 36 of SOLAS Chapter III, which are of very basic nature. Examples of this are

- *36.2 - maintenance and repair instructions;*
- *36.3 - schedule for periodic maintenance;*
- *36.7 - log for records of inspections and maintenance.*

6.4 Boat manoeuvre and maintenance

Based on the reports on drills conducted with the lifeboats and the times noted therein by the crews of OLIVER JACOB in accordance with the ISM Code, the Federal Bureau of Maritime Casualty Investigation assumes that in the year 2005 altogether 16 drills for abandon ship and one "person-over-board" manoeuvre were carried out on board OLIVER JACOB. 12 of the 16 drills were simple manoeuvres in which the crew members were mustered and went to the boats allocated to them. Within the framework of these drills the engines and steering systems of the boats were tested. In three manoeuvres the boats were lowered into the water but not detached from the boat runners. Here too the operation of the engines and sprinkler systems were checked. Both boats were only launched completely and operated in the water during the drill in June. This thus did not comply with the requirement under SOLAS. According Chapter III Rule 19 Point 3.3.3 "... *each lifeboat shall be launched with its assigned operating crew aboard and manoeuvred in the water at least once every three months during an abandon ship drill."*
The ISM manual of the vessel operator also calls for quarterly performance of lifeboat manoeuvres with the boat in the water.

The change of flag survey was conducted by a representative of Germanischer Lloyd Classification Society for the See-BG. On page 2 of the form used, "Periodical survey of accident prevention and ship-safety installations and equipment" the checkpoint *"Have boat drills been carried out 4 times a year? (boat launched, manoeuvring in the water)?"* is listed together with the reference to SOLAS Chapter III Rule 19. The corresponding assessment box was filled in with the synonym for "yes". The line below in which the four dates could have been inserted was not completed.

At the time of the accident neither of the officers had yet participated in actual launching of the lifeboats on OLIVER JACOB. Both were involved in one simplified watering during a drill. The seaman who had been on board longer had taken part in 6 simplified manoeuvres.

6.5 Training

Prior to their assignment the officers were trained as lifeboatman at German training institutions. Within the scope of the investigations the Federal Bureau of Maritime Casualty Investigation examined the training content and training media at three training institutions. It was ascertained that due to the many thematic areas to be covered, differing priorities were set. Appropriate media, i.e. a releasing hook system, was only present at two institutions. In both cases these releasing hook systems were of the same type by an other manufacturer and deviated in major points from the releasing hook system with central release from William Mills (Marine). Insofar

the opinion of one crew member of the OLVER JACOB that all lifeboats and release systems were of similar type proved false.
The experts of the US Coast Guard are of the opinion that the principle of the operating quadrants used in the release system of William Mills (Marine) is unique. In their opinion the lack of understanding concerning the function of the release system has contributed to the accident.

The „Manual for ship safety service training“ of the Marine Insurance and Safety Association also did not contain any information about centrally releasing hook systems.[14]
Hanging-off pendants were neither part of the training contents nor part of the manual.

6.6 Hanging-off pendants

On board OLIVER JACOB there were no hanging-off pendants. It was thus not possible to relieve the hooks while the boat was in the davits.
In the maintenance manual of William Mills (Marine) a monthly function test that must be carried out is described. After the boat is suspended in the hanging-off pendants, the release mechanism is to be operated. Furthermore, the possible inspection and maintenance of relevant components is described and explained.
The surveyors of the classification societies evidently did not find faults with the lack of such hanging-off pendants.
The Federal Bureau of Maritime Casualty Investigation assumes that if hanging-off pendants had been used for maintenance purposes the problem with the release unit would have been identified already at an earlier point. At the same time there would have been a possibility of familiarising the operators with the mode of functioning of the system.

The lack of presence of the hanging-off pendants was causative for the accident as on the one hand the applications described above did not take place and on the other hand they were not available for simple solution of the problem on the day of the accident.

6.7 Course of the accident

No indications of fatigue or the influence of alcohol were found with the persons involved in the accident.

The performance of a lifeboat manoeuvre was in line with the regulations required by SOLAS. The procedure, in other words launching the boat without a crew the first time, was carried out in accordance with the ISM manual of the vessel operator that was thus also in conformity with the recommendation of the MSC/Circ. [13] 1136 - Annex Point 2.3.3. The further course of the manoeuvre up to recovery of the boat

[14] The See-BG drew the attention to the fact that it is already being pointed out on the cover sheet of the „Manual for ship safety service training“ that all prescribed operation manuals are part of this manual. In addition they advised the BSU that the aforementioned manual is being issued by self administration institutions and that the recommendation of the BSU regarding the manual included in the draft investigation report will be conferred and implemented by the responsible board of the self administration.
[13] MSC/Circ. – Maritime Safety Committee/Circular

proceeded normally and without difficulties. The clothing of the boat's crew and the behaviour in the boat were in line with the regulations.

Analysing the result of the investigation the Federal Bureau of Maritime Casualty Investigation assumes that when resetting the release unit again the operator was confronted with the fact that the release handle no longer engaged in the secured position, as it was blocked by the aft operating quadrant. Resulting from this all other safeguards could not be activated either. The activities to be carried out for the purpose of securing/safeguarding were described clearly on the instruction plate LB 17i (Figure 19):

2 Check that release handle has fully dropped into its safety slots.

3 Put the button headed safety pin into place.

Already at this point the officer should have informed the vessel command and the recovery of the boat should have been abandoned until the problem was solved. In so far the non-action of the officer was causative for the accident.

The boat runners were hooked into the releasing hooks and heaving in of the boat was started. When the boat was free of the water surface, the safeguarding required under Point 8 on the instruction plate should have been carried out:

8 Confirm Hydrostatic indicator has moved back to the locked position.

The investigators assume that the manual release lever of the hydrostatic interlock in the port boat in the safeguarded position was in just such an unclear position as in the starboard boat of OLIVER JACOB (see Figure 21). Furthermore, the investigators established during the laboratory tests that when the hydrostatic unit was completely subjected to load by water, in other words unlocking, the release handle only moved upwards by 12.5°. This was roughly the width of the lever and was thus only a safe indication to those operators familiar with the special features of the system. As the operating officer had not participated in any complete launching manoeuvre with this boat up to the time of the accident, the investigators are of the opinion that he was unpractised in this respect.

After the boat had been stowed completely, the officers evidently discussed the problem that had occurred. No further information was given to the master and he was not informed of the further intentions.
It remains unclear whether the officers were familiar with the function of a hanging-off pendant. However, neither of the two asked about this.
No other crew members were involved in the decision to relaunch the boat of which the release system was still in an unsecured condition. Consequently it was not possible to reconstruct how and why this decision was taken.

The boat was manned again. Only the able seaman was wearing a helmet and life jacket. Thus the other two members of the boat's crew contravened § 34 Para. 2 of

the UVV See (Accident Prevention Regulations), "*The boat crews must wear life jackets for boat drills*".
The seaman fastened the safety belts properly. He survived the crash. In the opinion of the Federal Bureau of Maritime Casualty Investigation the officers only put on their belts in the lap area. This opinion is supported on the one hand by the damage pattern to the straps of the belts in the seat area and on the other hand the injuries sustained that led to the death of the two men.

After the accident the ship's crew acted quickly and within the scope of what was possible. The decisions taken by the master are plausible.

7 Safety recommendations

The following safety recommendations shall not create a presumption of blame or liability, neither by form, number nor order.

1. The Federal Bureau of Maritime Casualty Investigation recommends that the operators of sea-going vessels should:
   - provide their crews with up-to-date and comprehensive manuals for the lifeboats and release systems present on board;
   - include lists in the ISM manuals of the maintenance companies authorised by the manufacturers,
   - the provision of hanging-off pendants for maintenance purposes, provided that the release systems allow this, including the instruction manuals of the manufacturer, as well as inclusion of an appropriate procedure in the ISM manual,
   - should equip the lifeboats with the recommended pictographs that describe the handling of the release technology,
   - should implement the recommendations of MSC/Circ. 1206 – Measures to prevent accidents with lifeboats[14] - and back up the requirements of SOLAS Chapter III positively.

2. The Federal Bureau of Maritime Casualty Investigation recommends that vessel commands should:
   - observe the manuals for proper handling of releasing hook systems in operation, drills and maintenance,
   - use hanging-off pendants for maintenance purposes as far as the releasing hook systems allow this,
   - develop increased awareness of the risks of lifeboat manoeuvres, as well as for the importance of real drills,
   - unmistakably instruct their crews that in all unsafe situations drills must be abandoned immediately.

3. The Federal Bureau of Maritime Casualty Investigation recommends that classification societies should:
   - introduce a procedure to ensure that only authorised workshops carry out maintenance work to safety-relevant facilities,
   - introduce a clear inspection point in the survey guidelines that establishes the availability of maintenance and operating manuals and their conformity with the recommendations of MSC/Circ. 1205 – Guidelines for Developing Operation and Maintenance Manuals for Lifeboat Systems.

4. The Federal Bureau of Maritime Casualty Investigation recommends that manufacturers of releasing hooks use materials with higher wear resistance and better resistance to sea water. Furthermore the manufacturer should review their hook systems to the possibility of premature release due to inadequately maintenance and reengineer as necessary the release principle.

[14] Published in German in Verkehrsblatt 5/2007 of the Federal Ministry of Transport, Building and Urban Affairs

5. The Federal Bureau of Maritime Casualty Investigation recommends that German seaman's training facilities should extend the scope of training as regards centrally releasing hook systems. The handling of various types of releasing hook systems and the use of hanging-off pendants should become part of the syllabus.

6. The Federal Bureau of Maritime Casualty Investigation recommends that the See-BG should improve its monitoring of observance of the requirement of regular performance of drills with complete launching of the boats in accordance with SOLAS Chapter III Rule 19.

7. The Federal Bureau of Maritime Casualty Investigation recommends that the See-BG should include the following topics in the “Manual for Ship Safety Service Training”:
   - Centrally releasing hook systems
   - Hanging-off pendants.

8. The Federal Bureau of Maritime Casualty Investigation recommends that the Federal Ministry of Transport, Building and Urban Affairs suggests in the appropriate bodies of the International Maritime Organisation an evaluation in order to improve safety of existent and future releasing hook systems against unintentional release and against premature release due to wear.

8 Sources

- Investigations of the German Embassy in Cameroon and of the Federal Police
- Post mortem report of the Institute for Forensic Medicine at the University Clinic Hamburg-Eppendorf
- Written statements and comments by the vessel command and the vessel operator
- Statements by witnesses
- Expert opinion by Sachverständigenbüro Dipl.-Ing. Jan Hatecke
- Documents of the See-BG
  - Accident Prevention Regulations (UVV See)
  - Guidelines and bulletins
  - Vessel files
  - Manual for Training in Ships Securing/Safeguarding Service
- Chart of the BSH (Federal Maritime and Hydrographic Agency)
- MSC/Circ. 1049, 1093, 1136, 1137, 1205, 1206
- Publication of the International Life-Saving Appliance (LSA) Code in conjunction with the Resolution MSC. 48(66)
- SOLAS 1974, Chapter III
- Maintenance and Operation Manual "Titan" of William Mills (Marine) LTD 1997, 1999
- Study “Lifeboat Release Mechanism Testing” of the Canadian National Research Council – Institute for Ocean Technology, 09/2005
- Safety Study “Review of Lifeboat and Launching Systems’ Accidents” of the British Marine Accident Investigation Branch (MAIB), 01/2001
- Figures:
  - Fig. 2 — Homepage of the vessel operator - Ernst Jacob GmbH & Co. KG
  - Fig. 3, 4, 14 to 22 — Federal Bureau of Maritime Casualty Investigation
  - Fig. 5 — Hyundai Precision & IND. CO. LTD
  - Fig. 6, 7, 12, 26 — Manuals of William Mills (Marine) LTD
  - Fig 8, 23 to 25, 27 — Expert opinion by Dipl.-Ing. Jan Hatecke
  - Fig. 9, 13 — USCG in conjunction with Umoe Schat-Harding
  - Fig. 10, 11 — Vessel operator Ernst Jacob GmbH & Co. KG

9 Annex