



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

Investigation report 215/07

Very Serious Marine Casualty

**Death of two crew members
due to crash of the lifeboat
of the MV FOREST-1
during a lifeboat drill in Emden on
16 May 2007**

16 June 2008

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 proceedings or proceedings 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.

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1 Summary of the marine casualty

At the time of the accident, the MV FOREST-1, sailing under the flag of St. Kitts & Nevis, was berthed in Emden Harbour. The voyage from Papenburg to Istanbul had been interrupted at Emden as a result of technical defects.

During a Port State Control the representative of the See-BG¹ had amongst others ascertained deficiencies in the performance of the lifeboat drill and had issued a detention order.

The FOREST-1's single lifeboat was a combined life and rescue boat.

The crew carried out drills to improve their skills. On 16 May 2007, after an initial drill the ship's command ordered a second drill to be carried out. All stations were manned by the same persons as in the first attempt. While lowering the boat there was an incident that produced an increased load on the releasing hooks. Thereupon the aft releasing hook opened. The boat swung downwards, still held by the forward releasing hook. As a result of the excessive load, the forward releasing hook thereupon tore out of the hull of the lifeboat, which fell into the water from a height of 7 m. Ingress of water caused a quick sinking of the stern. Three of the six seamen in the boat were able to exit it. Two men died, one was seriously injured. The casualties were recovered by rescue personnel.

¹ See-BG – Marine Insurance and Safety Association

2 Scene of the accident

Type of event: Very Serious Marine Casualty , two dead and one serious injured as a result of the crash of the lifeboat
 Date/Time: 16 May 2007/13:20 LT²
 Location: Emden, Inner Harbour, Südkai
 Latitude/Longitude: ϕ 53°20,15'N λ 007°11,8'E

Section from the Chart 91, Federal Maritime and Hydrographic Agency

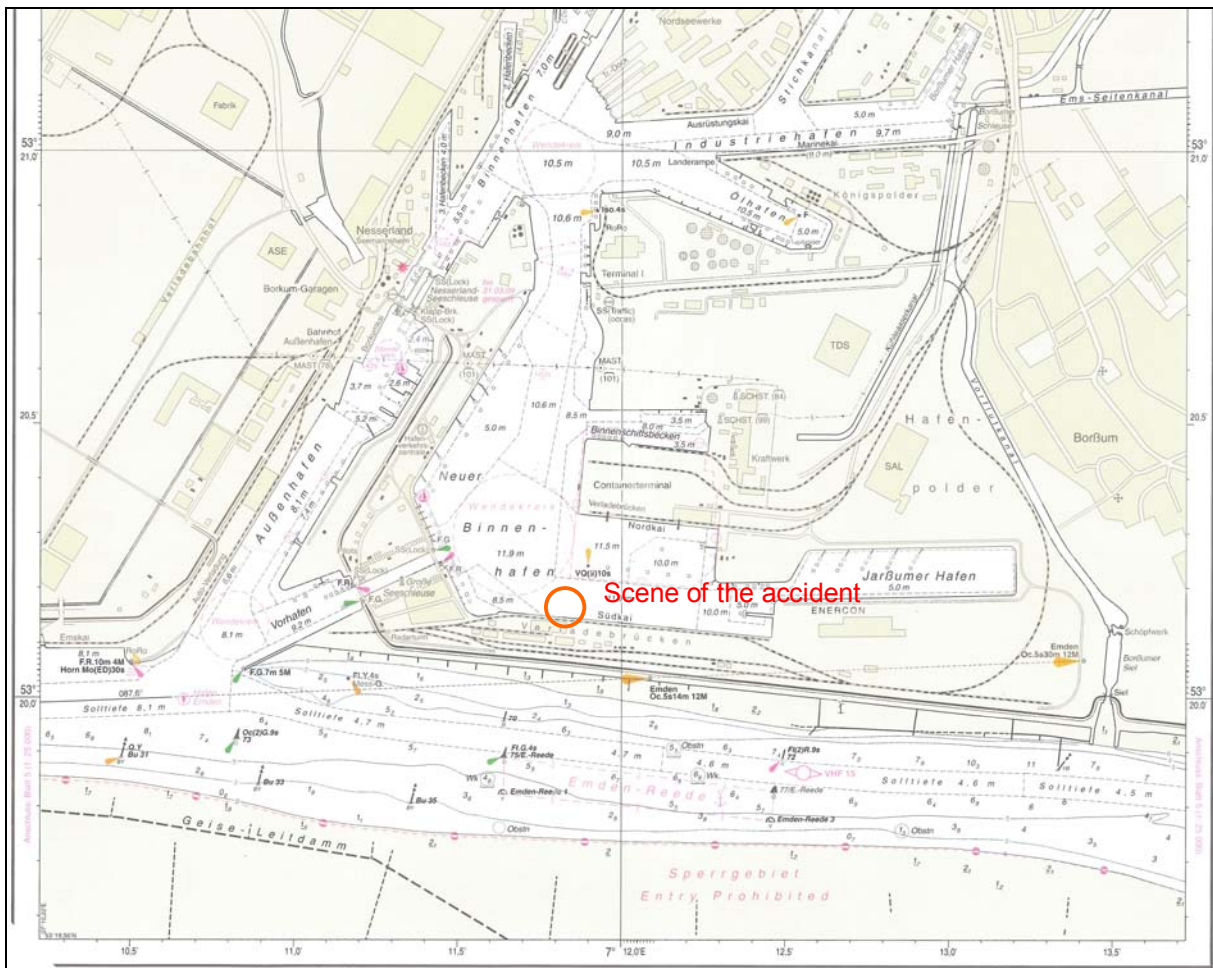


Figure 1: Chart

² All times in the report are given in LT (Local Time) = Central European Summer Time = UTC + 2

3 Vessel particulars

3.1 Photo



Figure 2: Vessel photograph, FOREST-1

3.2 Particulars

Name of the vessel:	FOREST-1
Type of vessel:	General cargo vessel
Nationality/Flag:	St. Kitts & Nevis
Port of registry:	Basseterre
IMO number:	9070515
Call sign:	V4HN
Owner:	Veiling Corporation, Belize
Vessel operator:	JSC North Eastern Shipping Company, Russia
Year built:	1993
Shipyard / Yard No.:	Severnnav Shipyard S.A.; Turnu Severin, Romania / 008
Classification society:	St. Kitts and Nevis International Ship Registry
Length overall:	86.04 m
Breadth overall:	14.5 m
Gross tonnage:	2,608
Deadweight:	3,117 t
Engine rating:	1,800 kW
Main engine:	B&W 4CY – 35/105
Hull material:	Steel
Number of crew:	12

4 Course of the accident

4.1 Course of the voyage

In Papenburg the FOREST-1 loaded 2100 t of logs. The voyage to the port of destination Istanbul started on 8 May 2007 with a passage down the river Ems. At approximately 20:30, off Emden, the pilot refused further services due to technical defects of the vessel. Thereupon the ship entered the port of Emden and moored with port side at the Südkai in the inner harbour. The See-BG issued a detention.

On 9 May 2007 a Port State Control carried out by a representative of the See-BG took place on board the FOREST-1. Within the scope of this control, at 12:00 noon an “Abandon ship drill” was ordered for 14:30. During this drill, the starboard boat was launched. The performance of the crew during this drill led the inspector to discontinue the drill. This fact and further deficiencies that had been ascertained were reasons to lead to a repeat inspection at a later date. No safety relevant defects were observed on the lifeboat or its launching system during the drill.

According to statements from the crew, the “Abandon ship” drill was performed a second time on 15 May 2007. The investigation was unable to determine with certainty whether the lifeboat’s releasing hooks had been released during this manoeuvre.

4.2 Course of the accident

At around 13.00 on 16 May 2007 the Master reportedly once again alerted his crew for an “Abandon ship” manoeuvre. Six crew members had reportedly manned the boat entering it via the access hatch on the port side. Each crew member was said to have taken an immersion suit on board in a bag. Life vests were also said to have been worn. The Bosun reportedly operated the centrifugal brake on the winch and was said to have been assisted by a deck rating. Two other crew members were said to have led the bow and stern painters on board the FOREST-1. The boat was reportedly lowered and subsequently hoisted back in. The drill had reportedly been completed at 13:15. Following a meeting concerning the course of the drill, it was reportedly decided to repeat it.

No mention was made of an incident at the boat winch in the Master’s further statement. As a result of a handling error the winch momentarily jammed during the lowering process resulting in a heavier load on the releasing hooks. Further details are given in Section 5.10.

At 13:25 the crew reportedly began to repeat the drill in the same positions. The aft releasing hook is said to have released while the boat was being swung out. In falling, its stern reportedly struck the boat deck. Through the impact the access hatch on the port side was said to have opened. The boat reportedly hung on the forward davit, stern downwards, for a short moment. Then the forward releasing hook together with the keel fastening reportedly broke out of the bow, and the boat fell a distance of approximately 7 m. Once in the water, the lifeboat reportedly developed a heavy list to port. Water was said to have entered the boat via the open hatch, causing the boat to capsize. One of the crew members reportedly left the boat by diving out of the port hatch. Two others were said to have escaped via the stern

hatch. According to reports, the lifeboat was later more than half submerged, stern down.

After the accident, the Master reportedly informed the relevant authorities a shore. At the same time the crew was said to have placed a line around the boat and tried to keep it from sinking by means of a shipboard crane.

Towards 14:15, rescue personnel reportedly reached the vessel and recovered the three crew members who remained inside the boat.

After initial reanimation attempts, the recovered crew members were taken to hospital. Two of them died in hospital. The third seaman was in a coma for a long time. In the meantime he has been repatriated. His convalescence is uncertain.

The lifeboat was deposited on a wharf of the local building yard with the aid of a buoy-laying vessel, and secured there by the Waterways Police.

4.3 Damages

There was no damage to the FOREST-1 itself. As a result of the damage that had taken place during the accident, the davit system had become inoperative. The boat winch, too, had been damaged during the events.

The BSU did not obtain knowledge of any environmental pollution.

5 Investigation

5.1 Forest-1

The vessel was built in 1993 at the Romanian Severnav S.A. shipyard as a general cargo vessel.

5.2 Launching device

The launching device was located on the boat deck, two decks above the main deck. The davits area was delimited forward and toward midships by the superstructure. The gravity davit system used on the FOREST-1 enabled lowering the boat into the water independently of electrical drives. The start of the lowering procedure and the lowering speed were regulated by means of a brake integrated into the releasing winch. In case of emergencies, the brake could be operated from inside the boat via a guided wire rope. Under normal circumstances the brake was operated by a lever located directly on the winch. Lowering the boat by means of the electric motor was also possible. One electrical winch activation push button switch was located on the winch itself, and another on the superstructure in the area of the forward davit.

To recover the boat, it was necessary to have a person on board the ship. Hoisting could be motor driven or manual. In order to place the boat into its final stowage position it was obviously necessary to use a crank handle. This crank handle was stowed next to the winch and, if its use was required, had to be inserted onto a square protruding from the winch housing.

At the time of the accident, four people were in the immediate vicinity of the boat – the winch brake operator and his assistant, and two crew members who were supposed to handle the forward and aft painters.

Short descriptions in Russian and English, drawings and pictograms concerning the operation of the lashings, the davit system and the winch were posted on the sides of the superstructure in the boat deck area (Fig. 3).

The crash of the boat severely damaged the forward davit arm. The entire arm was bent aft. The plunger of the hydraulic shock absorber was bent (Figures 4 and 5).

After the accident, the Waterways Police ascertained that the winch crank handle lay, broken and bent, on the deck next to the winch. The electrical switching device, intended to prevent motor operation of the winch when the handle was set on its square, had been torn off.



Figure 3: Description of the launching procedure in Russian and English, posted on the boat deck



Figure 4: Shock absorber plunger



Figure 5: Forward davit arm starboard side

5.3 Lifeboat

The lifeboat involved in the accident was examined by a BSU team on the building yard site in Emden.

The FOREST-1 was originally equipped with two lifeboats. The port boat was also suspended from a davit system. As a result of the poor maintenance condition of this particular boat, upon request from the operator and in accordance with the rules set forth in SOLAS Chapter III Rule 31 No. 1.3, on 11 April 2006 the former classification society Det Norske Veritas (DNV) amended the Cargo Ship Safety Equipment Certificate in a manner such that now only the starboard boat was recorded as a life and rescue boat. The port side boat was still on board at the time of the accident.

The starboard lifeboat was a product of the Severnav S.A. company, i.e. of the yard that had built the vessel. It had been built as an enclosed, combined life and rescue boat and according to the classification certificate of the Romanian Register of Shipping had the following specifications:

- Classification number: 40/1864
- Yard number: 4182
- Year built: 1993
- Length: 7.15 m
- Breadth: 2.70 m
- Weight (incl. motor, equipment and crew): 4,260 kg
- Number of occupants: 32 as a lifeboat, 6 as a rescue boat
- Engine output: 28 hp
- Material: Glass-fibre reinforced plastic



Figure 6: Combined life and rescue boat of the FOREST-1

The BSU assumes that the weight of 4,260 kg mentioned in the inspection certificate of the Romanian Shipping Register is not correct. The certificate states the weight to include the engine, equipment and passengers. At a standard weight of 75 kg per person the total weight for 32 people would be 2,400 kg. The boat including its motor and all equipment would therefore only weigh 1,860 kg. This is an unrealistic value. For this reason, for all further considerations it was assumed that 4,260 kg was the weight of the fully equipped boat. The fully manned boat would therefore weigh 6,660 kg. From that it could be concluded that the hook test carried out according to the abovementioned classification certificate with a weight of 6,650 kg would refer to one hook and would have been carried out at 2 x SWL³.

The crew boarded the lifeboat in its stowed position. To do so, crew would move from the bridge deck onto a platform integrated into the davit construction. Access to the boat took place via a large opening in the side of the upper hull shell. This hatch closed by means of a cover folding outwards and upwards. A similar hatch could be found on the opposite side of the boat. There was another outward opening, gate-like, right-hand hung hatch on the starboard side of the stern. This hatch enabled access to a platform from which the aft releasing hook could be operated. A lockable hatch opening upwards and outwards and enabling operation of the forward releasing hook was located at the bow. On top of the upper hull shell was a windowed helmsman's dome. A raised seat was installed in the boat at this station. This area also included the controls for the motor and the wheel.

For the crew the boat was fitted with a bench running around. The seats were fitted with a loose cover, insertable pelvic cushions and headrests. Each seat was fitted with a lap belt similar to a car seat belt. A metal plate at the end of the belt strap locked into a buckle fixed onto a flexible fitting (Figure 7).

During the investigation it was determined that most of the belts and buckles were packed in plastic foil and therefore not immediately available for use. Despite the packaging, most of the belt buckles inspected were found to be either difficult to operate or inoperable due to corrosion.

The general condition of the lifeboat was deficient. For example, the stern of the boat in the area of the keel above the stern tube was filled with expanding foam. The engine cover was stored on the bridge deck. It had been removed from the boat because of its bulky size.

³ SWL – Safe Working Load

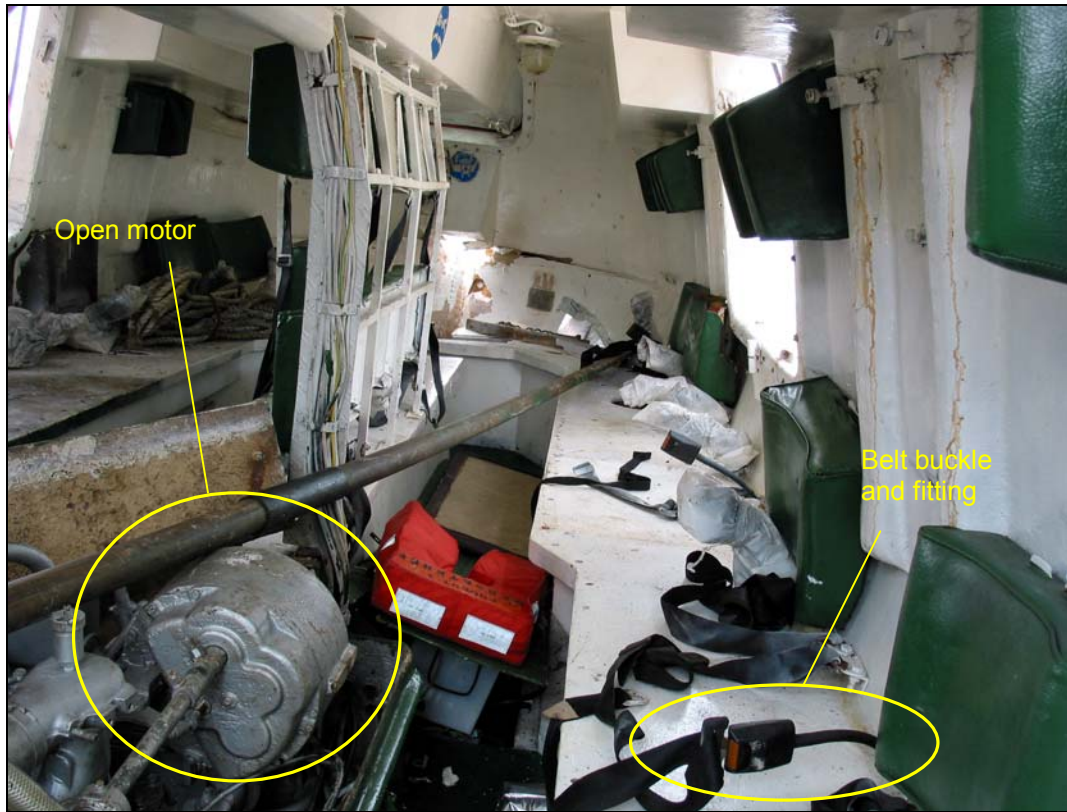


Figure 7: FOREST-1 lifeboat, starboard side, view towards the bow

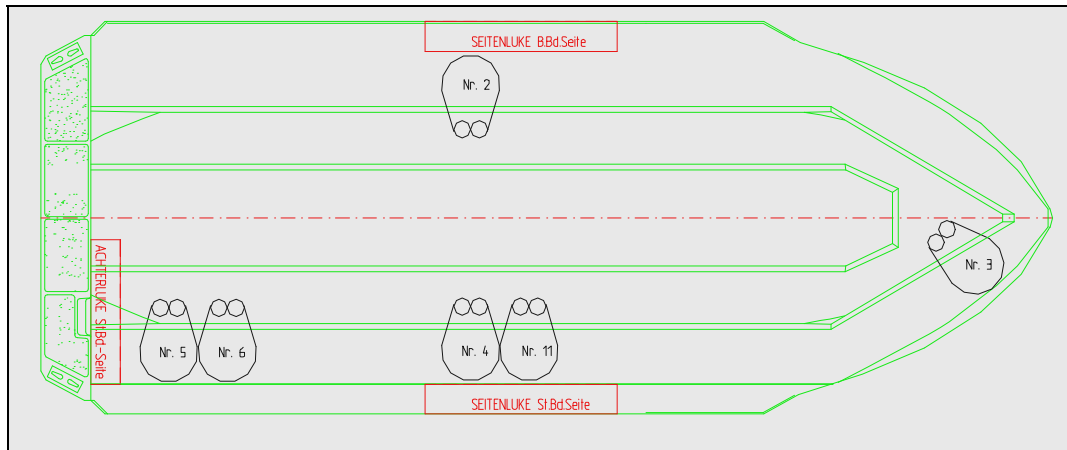


Figure 8: Seating locations in the lifeboat

Legends: (top) Side hatch port side; (bottom) Side hatch starboard side; (left) Aft hatch starboard side

At the time of the accident six people were in the lifeboat (Figure 8). The numbers in Figure 8 refer to the position in the crew list:

- No. 2 Chief Officer
- No. 3 Second Officer
- No. 4 Chief Engineer
- No. 5 Second Engineer
- No. 6 Electrical Engineer
- No. 11 Motorman

None of the people on board used a safety belt. Only some wore life vests.

5.4 Damages to the boat

The following damages to the starboard lifeboat were ascertained during the investigation in Emden:

- the forward releasing hook had broken out of the bow in a forward direction together with the hull fitting (Figures 9 and 11),
- this caused the wire ropes of the forward hook remote control to tear (Figure 12),
- stern window of the helmsman dome destroyed,
- cover of the port side access hatch bent,
- stern platform railing bent,
- hull broken open on the aft port side (Figure 10).



Figure 9: FOREST-1 lifeboat



Figure 10: Hull broken open on the port side aft



Figure 11: Damage to the bow due to releasing hook having been torn out; A = hook for forward painter



Figure 12: Forward releasing hook

5.5 Releasing gear

The FOREST-1's life and rescue boat was equipped with a central releasing gear. As no manufacturer reference could be found on the entire system it is assumed that Severnav S.A. had also manufactured the releasing gear. There was also no indication of any model, type or maximum load information.

The central releasing gear of the FOREST-1 consisted of the following components:

- A directly operable releasing hook aft and a remote control operation releasing hook forward. A suspension ring was hooked into each of the releasing hooks. This suspension ring was in turn fastened to a boat runner, rigged as a double whip. The wire ran onto the boat winch via the davit arm and guide rollers.
- Central release took place via a wire rope connection between the forward and aft release rod assembly. These wire ropes ran through guide tubes on the boat's port and starboard sides.
- No hydrostatic interlock had been installed.

Certain conditions require the boat to be released while it is still fully suspended in the boat runners. This option is called On-Load-Release. The investigation did not include determining whether this particular releasing system would enable use of an On-Load-Release option.

5.6 Releasing hooks

The releasing hook consisted of two vertical support plates and the actual hook between them. The support plates narrowed sharply toward the bottom and were connected to the keel of the lifeboat.

The hook was designed, built and positioned between the plates in a manner such that when not under load (pull on the hook) its opening pointed downwards. Under tensile load via a suspension ring hooked into the device, the hook would have turned around the bearing shaft. The opening would then have pointed upwards and the hook would have released the suspension ring. In order to control this rotation and therefore the opening of the hook, in the secured position the tail of the hook abutted a rotatable socket. The socket, described as a release claw, was open at an angle of approximately 180° and connected with the release lever via the release rod below. Turning the release lever simultaneously also turned the release claw and released the hook (Figure 13).

Originally, a rotatable steel bushing was set on the end of the hook tail and secured with a snap ring. This bushing was supposed to reduce the mechanical wear on the release claw during release.

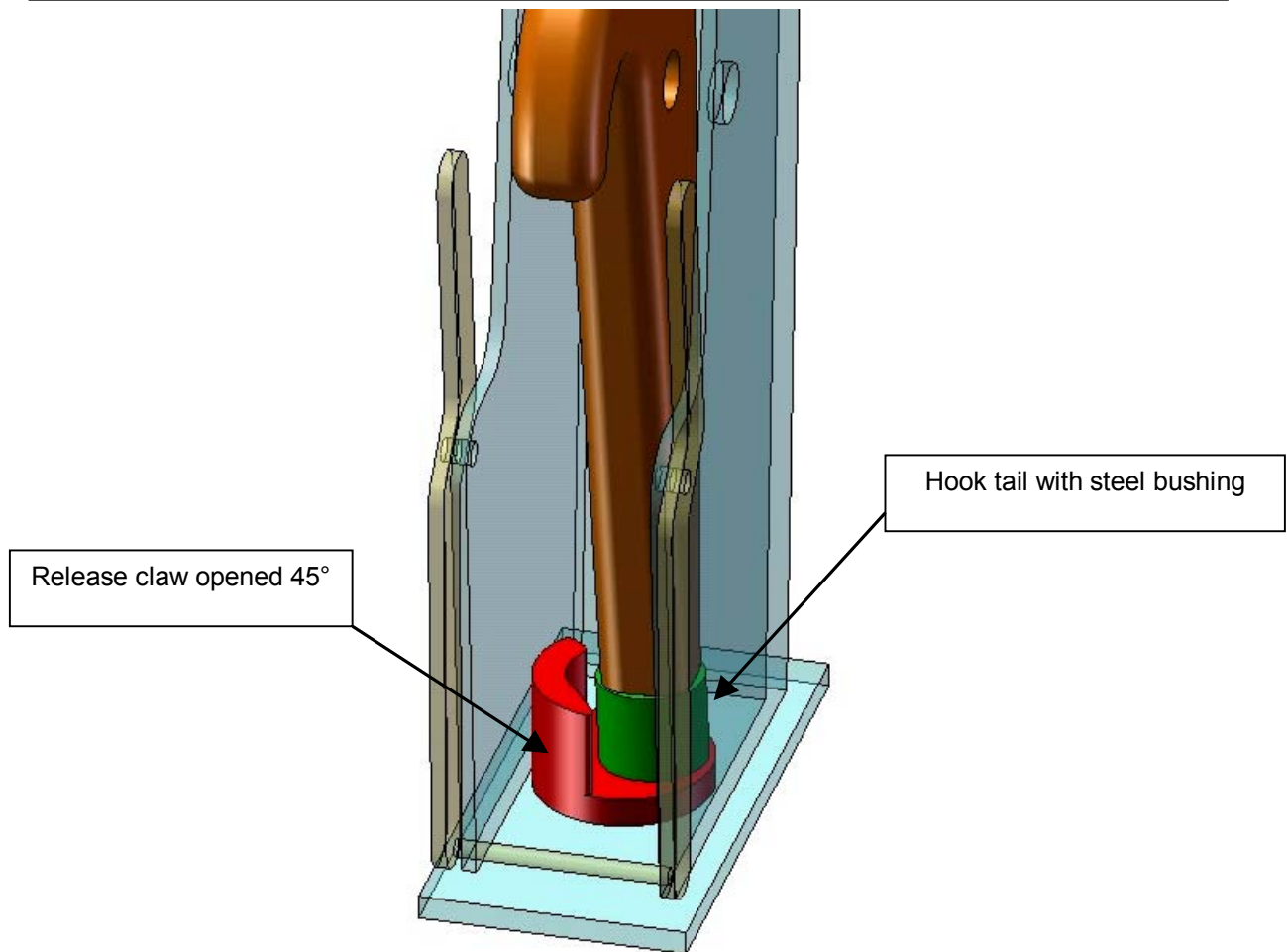


Figure 13: Interlock mechanics of the releasing hook

5.7 Release mechanism

Operation of the entire system, i.e. unsecuring, releasing and securing, took place directly on the aft releasing hook.

At the beginning it was necessary to raise the release lever from a downward pointing position into a horizontal position. This movement was carried out against the resistance of a spiral spring set onto the release rod and thus representing a kind of safeguard (Figures 15 and 16).

Release was effected by means of a horizontal rotational motion of the release lever to starboard (Figures 14, 16 and 18). This movement was theoretically supposed to be possible only when a locking sleeve that was also mounted on the release rod had been manually lifted (Figures 14 and 17). This locking sleeve therefore also fulfilled the function of a second safeguard against unintended release. In the tests conducted on board the lifeboat of the FOREST-1 the safeguard could be overcome with a normal effort, and without lifting, as a result of wear on the locking sleeve.

Once the release lever had been horizontally moved all the way to starboard, the release claw would have turned to such an extent that it released the hook, which then opened.

A metal arm was permanently affixed on the lower part of the release rod assembly. In turn, the two operating wire ropes for the forward releasing hook were fastened

Ref.: 215/07

onto this arm. The motion of the aft releasing hook rod assembly was in this way transferred to the forward releasing hook (Figure 14).

In emergencies it was possible to independently release the forward releasing hook by means of an attachable lever arm and without releasing a further interlock.

The system was reset by performing the above actions in the reverse sequence.

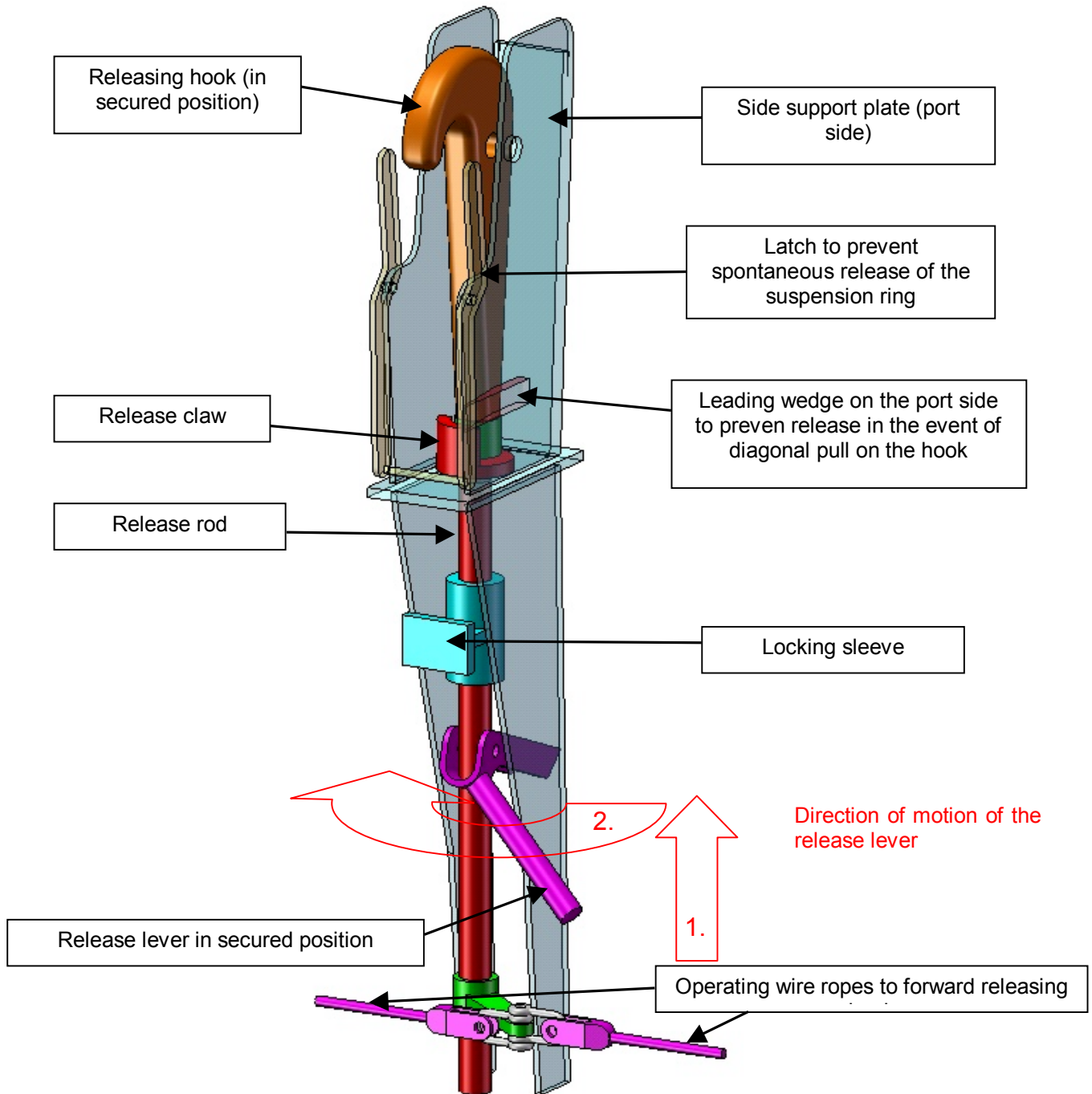


Figure 14: Aft releasing hook with release lever and wire rope linkage

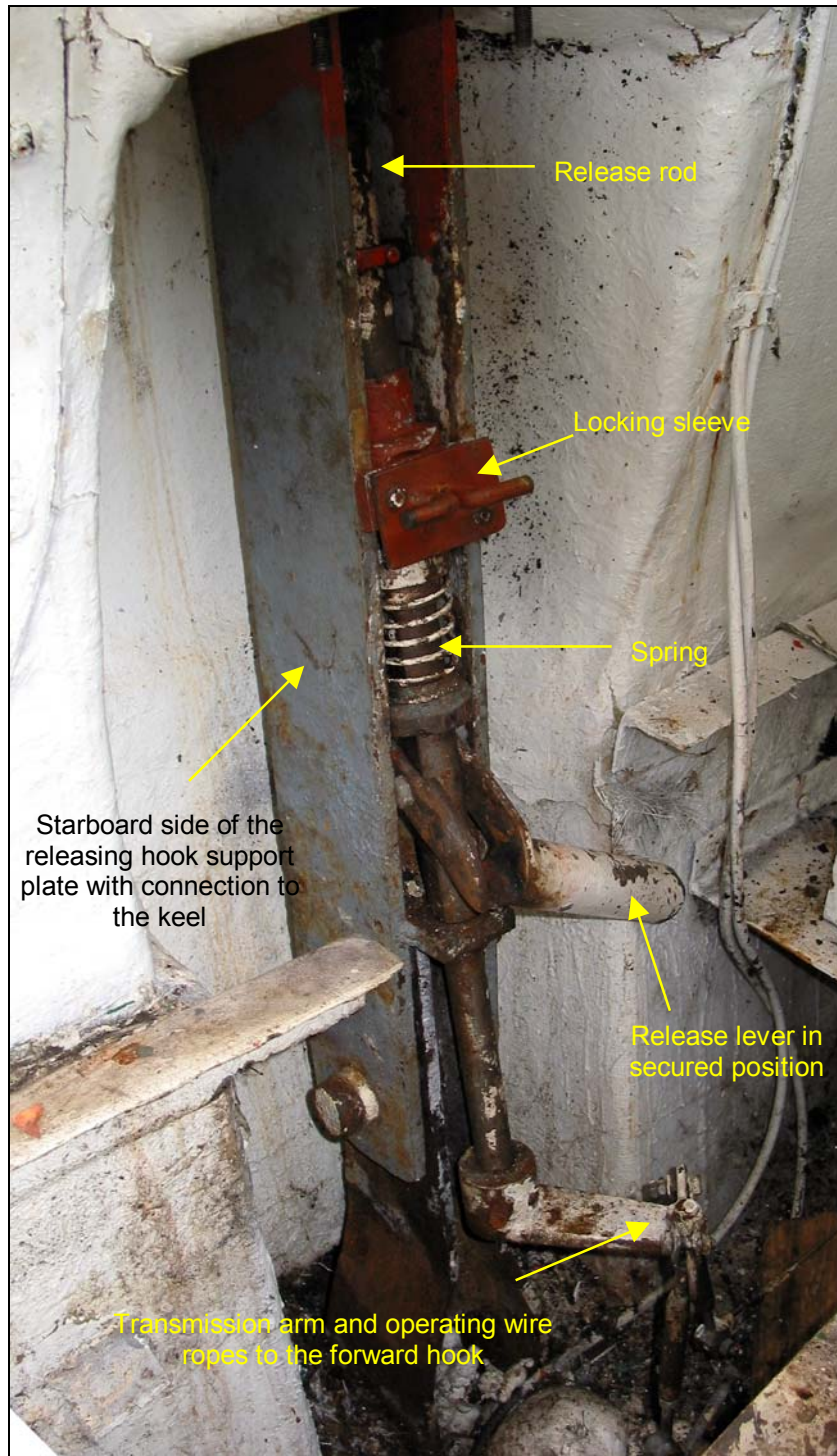


Figure 15: Aft release unit, release lever in secured position, pointing to port



Figure 16: Aft release unit; release lever raised, spring under tension

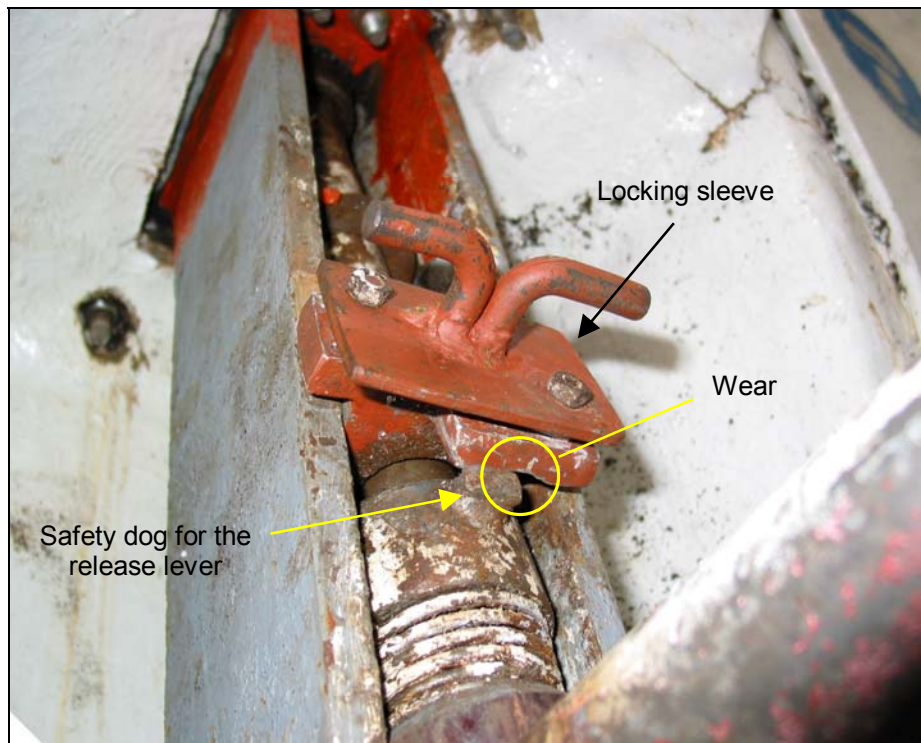


Figure 17: Locking sleeve in raised position (seen from below); release lever turned approx. 50° in the direction of release



Figure 18: Release lever in release position

The transfer of the motion of the release lever to the forward releasing hook could not be verified as the forward releasing hook operating wire ropes had been torn off by the crash of the boat. It could however be determined that the guide tubes were heavily corroded (Figure 19) and that in the forward port side area there was no connection with the inner skin of the boat, which resulted in play in the system.



Figure 19: Guide tube for the starboard operating wire rope at the forward exit point

5.8 Signage

The labels found glued inside the lifeboat of the FOREST-1 made reference to the following functions:

- Opening the hatches,
- Fastening [seat] belts
- Remote winch operation.

Aside from a description of the lubrication points and of the lubricants for the boat propulsion system existed no descriptions of any other functions or procedures in the lifeboat.

5.9 Manuals

The crew of the FOREST-1 was unable to provide a manufacturer's manual for the operation or maintenance of the lifeboat or the release unit.

Further to enquiry by the BSU, Severnav S.A. provided several documents including a manual entitled "General Operation and Maintenance Instructions". However, the procedures described therein for On- and Off-Load-Release were not comparable owing to a different design and construction of the release mechanism. The sketches contained in the Manual enabled only a superficial impression of the release mechanism described therein and were not suited to help understanding or inspection of the system.

The ship's command provided a "Training and Instruction Manual" written in Russian as being a component of the on-board manual according to the ISM-Code⁴. These guidelines were very general. Thus there was a reference to fire-resistant boats that

⁴ ISM-Code – International Management Code for the Safe Operation of Ships and for Pollution Prevention

were not present on the FOREST-1. The cover page of the Manual did not contain the name of the ship, but rather that of the “Middle Volga Shipping Company”. The investigators were unable to determine any relationship between the vessel and this shipping company.

In any event this Manual, under item 2.2.8, which discusses manning/entering, lowering and hoisting, at least stated, in a subitem concerning the winch: “– to be ... checked, that the hand crank is not on the winch gear.”

5.10 Course of the accident

Independently from each other, both the Waterways Police and the BSU interrogated several witnesses of the accident. As concerns the crew inside the boat, it can be said in summary that none of its members admitted to having activated the release mechanism. The boat crew was reportedly entirely surprised by the events. Because of their seating positions within the boat they had no knowledge of events outside the boat.

There were differing and partially contradictory statements as to the events and/or proceedings on the main deck. Based on the findings of the investigation, the following course of events is the most likely: On 16 May 2007, the boat drills took place in relatively quick succession. After the first drill, the starboard lifeboat was hoisted back in to its fully stowed position by means of the hand crank set on the winch. The hand crank was not taken off afterwards. For the second drill, the lowering procedure was started at the winch by releasing the brake. The winch crank turned with the winch, slipped from the square, jammed, and broke. The jamming of the hand crank resulted in a sudden stop of the lowering process, causing a heavy load on the lifeboat releasing hooks.

It is also possible that a momentary electrical lifting motion may have been initiated by actuating the electric push button on the superstructure and that this countervailing motion would have generated a load.

The peak load led to the release of the aft releasing hook of the FOREST-1. The stern fell and in doing so struck the outboard edge of the boat deck with its port side. This damaged the hull of the boat (Figure 10). The boat then hung for a few seconds from the forward releasing hook, stern downwards. The suspension system was unable to resist the forces acting on it and broke out of the bow of the lifeboat (Figure 11). The boat crashed onto the water’s surface from a height of approx. 7 m.

After the crash, a large amount of water immediately rushed into the boat. The investigators assume that this occurred on the one hand through the open or not entirely closed aft hatch and via the smashed aft window of the helmsman’s dome. On the other hand, water also entered via the hatch on the port side, which had opened due to the impact. As a result of the water taken on, the stern remained submerged and the boat did not return to its normal flotation position.

5.11 Recovery

A great number of emergency doctors, paramedics and fire fighters participated in the rescue effort.

As described in item 4.2, the crew had partially raised the lifeboat out of the water with the bow pointing upward by placing a line around it and lifting it with the shipboard crane. However, the rescue personal were unable to access the boat.

Later the boat was raised further. This enabled the rescue personal to access the area of the lifeboat's aft hatch. A fire brigade boat and a fire brigade diver were employed in this part of the rescue effort. Following removal of equipment items that blocked the entrance they were able to recover three crew members via the aft hatch.

5.12 Boat drills

The ship's command stated that boat drills were performed continuously. Drill lists according to SOLAS, drill reports and excerpts from the ship's log books from October 2006 onwards were available for inspection.

The following was concluded further to evaluation of this documents:

- Except for a short period of interruption, the Master had been in charge since December 2006.
- Except for the Bosun, who had joined the ship at the end of March, the entire crew had been on board since January 2007.
- In 2007 the lifeboat was launched on 22 April and on 15 May, and the releasing hooks were released.
- According to the log book and the list, the boat was also launched on 17 January, 7 February and 6 March. On those days the ship was at sea. On the basis of the nautical miles covered in the relevant periods of time, an average speed of 10 kn was calculated. This in turn gave rise to the assumption that the lifeboat was neither lowered nor launched.
- There was no entry in the ship's log of an "Abandon ship drill" allegedly carried out on 7 April.

5.13 Technical acceptance of the lifeboat

The lifeboat had been certified by the Romanian Shipping Register in 1993.

The ship's command submitted a Cargo Ship Safety Equipment Certificate. This certificate had been issued by the International Register of Shipping in Moscow on 3 May 2007. It was valid until 25 May 2007. The report underlying the certificate was not presented. It could thus not be determined where the inspection had taken place.

Boat launching equipment must be tested at regular intervals. The ship's command submitted a test certificate from the LP – Brodogradilište shipyard in Mali Lošinj, Croatia dated 12 October 2006. According to this certificate, the releasing hooks, the boat and the davits had been tested. In its text, the document did not make specific reference to the testing requirements set forth in SOLAS Chapter III Rule 20 No. 11 and the LSA Code⁵. During the tests that were carried out the weight of the boat had reportedly been increased to a total weight of 13,270 kg by the addition of weights and had been suspended from the hooks in this configuration. Another test, intended to test prototypes according to MSC 70/23 Add. 1 Annex 6 Paragraph 6.3.5, was reportedly also carried out. This test measured bending under load.

All attempts made by the expert of the Office of the Public Prosecutor to contact the shipyard failed. Thus no further information could be obtained.

⁵ LSA-Code (Life-Saving Appliances-Code)

5.14 Service

An employee of Severnav S.A. stated that the shipyard had stopped manufacturing lifeboats approximately ten years ago. The yard continued to provide a lifeboat repair service. However, this service was only provided for vessels sailing under Romanian flag. He made reference to two other companies in Constanta, Romania. Attempts to contact these companies failed. The information provided by the employee of Severnav S.A. allows for the conclusion that there is no authorised service workshop outside of Romania. Within Romania, too, the existence of an authorised workshop is questionable.

5.15 Changes in classification of the vessel

According to information provided by the Severnav S.A. shipyard, the ship was commissioned under the supervision of the Germanischer Lloyd (GL). No confirmation of this could be found in the records of the GL. What is certain is that the GL had been the ship's Classification Society from November 1997 to August 2002. During this period of time, both lifeboats of the FOREST-1 were listed in the Safety Equipment Certificate.

According to information provided by the Classification Society Det Norske Veritas (DNV), the ship changed over to this class on 24 August 2002 while sailing under Singapore flag. From 9 April 2003 to 11 April 2006 the ship sailed under Russian flag. During this period of time, DNV carried out only classification tasks. On 11 April 2006 the ship changed over to St. Kitts and Nevis flag. In this connection, DNV issued a ship's safety certificate valid for one month. This issuance contained certain requirements and prerequisites in respect to the vessel. The port side lifeboat was withdrawn from service at the same time. As their requirements were not met, DNV withdrew on 16 May 2006. The function as Classification Society and flag state's recognised organisation were taken over by the International Register of Shipping.

5.16 Port State Controls

As the FOREST-1 increased in age, so did the deficiencies ascertained on the occasion of Port State Controls carried out according to SOLAS Chapter I Rule 19. Thus, 77 deficiencies were found between January 2006 and April 2007. This also led to detentions of several days in December 2006 and in January 2007. The lifeboat accident here under investigation also took place during a lay period due to detention. Twenty other deficiencies were found during the Port State Control carried out by the See-BG in Emden.

5.17 Expert's investigation

Within the scope of the investigation carried out by the public prosecution service, the Aurich Office of the Public Prosecutor intended to commission an expert with the examination of the central releasing system of the FOREST-1. For the selection of the expert and the procedural approach, the OPP Aurich fell back on the experiences gleaned by the BSU from the investigation of the lifeboat accident in relation to the OLIVER JACOB.

The forward and aft releasing hooks were submitted to Marine Consultant Jan Hatecke, Grad. Eng.. The goal of the survey inspection was to determine whether a spontaneous release was possible with the release lever in the secured position. If so, the necessary force was to be measured. For the inspection the expert contacted the Institute for Materials Science and Welding Technology of the University of

Ref.: 215/07

Applied Sciences in Hamburg. There, the aft releasing hook was built into a frame that enabled application of varying forces to the hook (Figures 20 and 21). The forward releasing hook had been so severely damaged during the accident that no further tests could be carried out on it. BSU representatives were present during the experiments.



Figure 20: Test frame with aft releasing hook (lateral view)

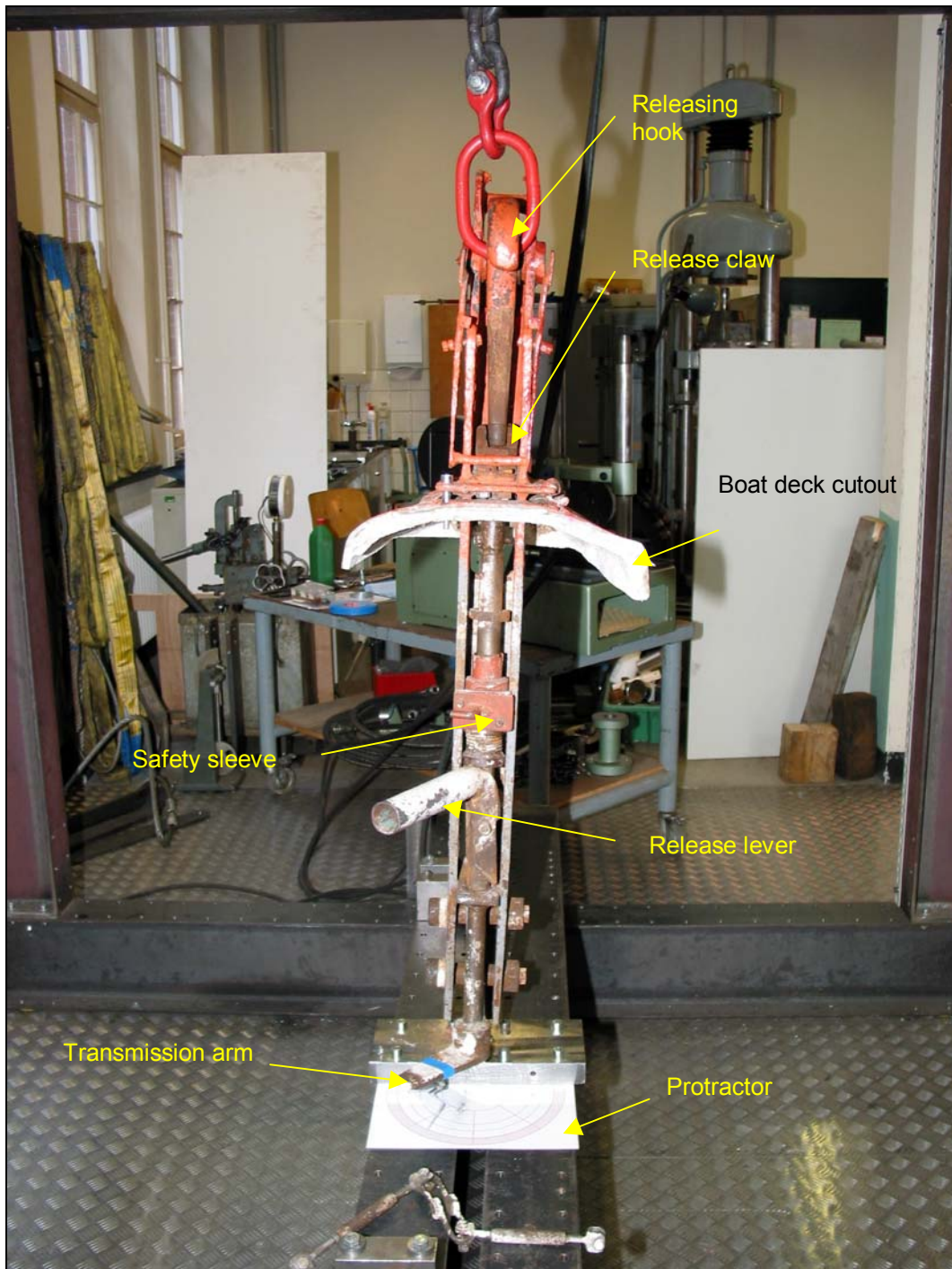


Figure 21: Test frame with aft releasing hook (frontal view)

5.17.1 Examination of releasing hooks

Visual comparison between the forward and aft releasing hook revealed the following deficiencies on the aft releasing hook:

- **Missing steel bushing** at the hook tail (Figure 22). This bushing had been missing for some time, as the groove designed to accept the snap ring was already severely damaged. Under load, the snap ring could no longer hold the bushing on the hook tail. The missing bushing caused a strong mechanical wear on the release claw and thus a decrease in the area intended to hold the hook tail.

In addition, the absence of the bushing reduced the diameter of the hook tail. This also led to a reduced effective area.

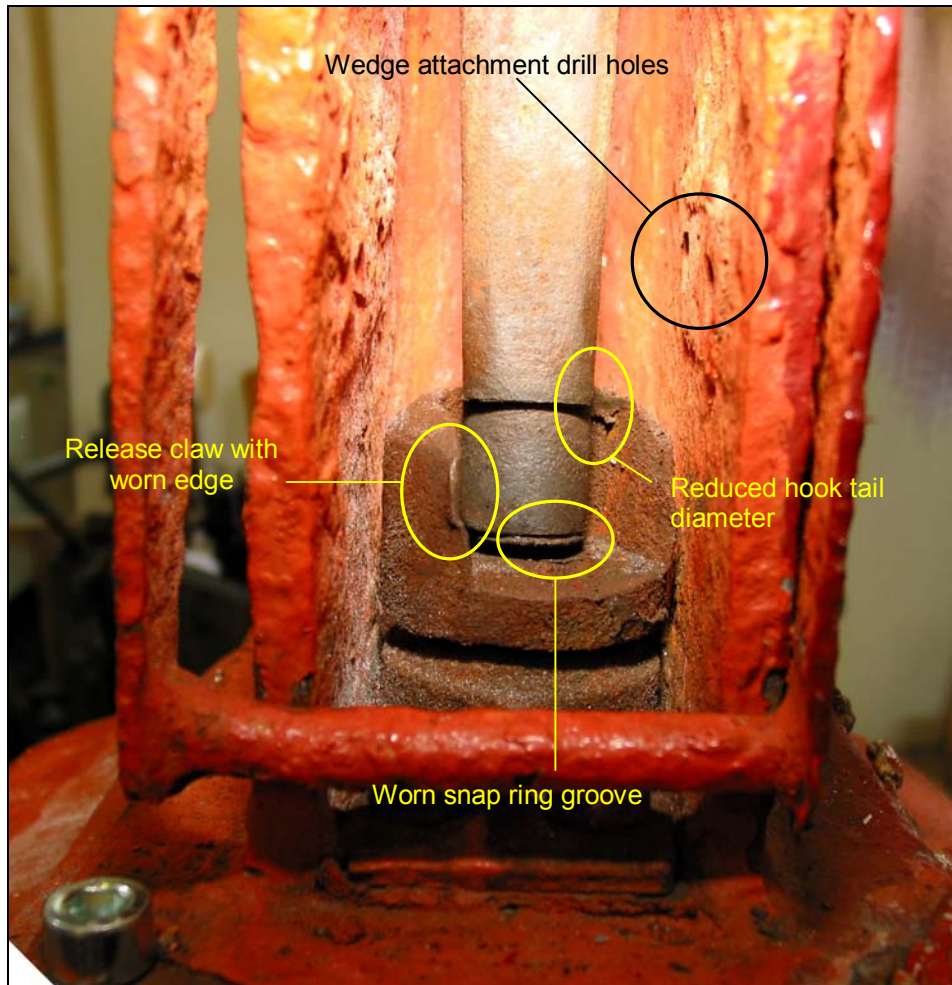


Figure 22: Aft releasing hook

- **Missing wedge** on the inside of the port support plate of the releasing hook (Figures 22 and 23). This wedge had also been missing for some time. Both the attachment area and the drill holes were thickly covered in old paint. With load on the hook, the missing wedge causes the hook tail to move to port (Figure 24). This in turn reduced the holding performance of the release claw.

In some tests, the missing wedge was replaced with a metal piece of equal strength.



Figure 23: Forward releasing hook

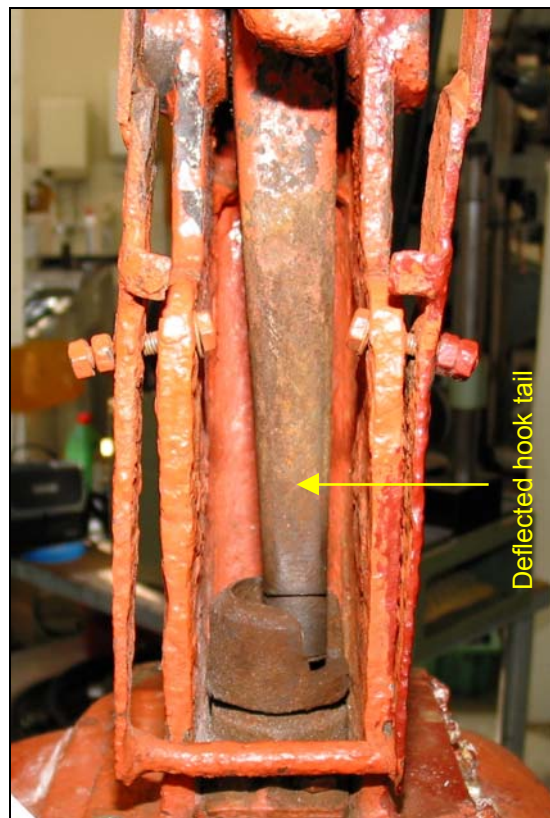


Figure 24: Aft hook tail without bushing

5.17.2 Release test

After the accident, the expert weighed the empty boat at 5,200 kg. This weight does not agree with the weight of 4,260 kg mentioned in item 5.3. On the one hand, at the time of weighing there was still a small amount of water in the boat, on the other hand it could be assumed that some portions of the boat had become waterlogged. It is also possible that modifications may have resulted in a weight increase.

In his tests, the expert assumed a weight of 5,200 kg.

In designing the test it was possible to measure the forces applied via a hydraulic cylinder as well as the torsion resulting therefrom within the releasing hook rod assembly.

In the frame, the aft releasing hook was subjected to forces of up to 70 kN, starting at 28 kN and increasing in steps of 14 kN. 28 kN corresponded to half of the sum of the weight of the boat plus that of six persons, i.e.

$$\begin{aligned}
 &5,200 \text{ kg} + (6 \times 75 \text{ kg}) / 2 = 2,825 \text{ kg} \\
 &2,825 \text{ kg} = 27.682 \text{ kN} \quad \rightarrow \quad \approx 28 \text{ kN}.
 \end{aligned}$$

Static tests:

With the release lever in the fully secured position, the releasing hook held a load of 70 kN. The load was also sustained after the hook tail had been manually fully pushed to port.

After the accident the release lever had not been found in the fully secured position. Because of this unclear situation the expert first attempted to ascertain the minimum

opening angle of the release lever at which release would have taken place. Without the bushing, release took place at an angle of 12.5° and a force of 69 kN. With the bushing, the system released at an angle of 10° and a force of 71 kN. During these tests the release rod assembly in itself was observed to rotate a maximum of 4°.

Dynamic tests:

With the release lever in the fully secured position and in order to re-create a realistic stress situation, the system within its frame was subjected to lateral impact by means of a wooden beam. The impacts were repeated after every increase of the applied force.

During these tests a rotation of the release rod assembly in itself was observed at 14° with the mounted bushing and at 11° without.

Without the bushing, release took place at a force of 56 kN. With the bushing fitted, a force of 70 kN could be sustained.

The absence of the wedge was compensated by adding a 15 mm thick flattened steel bar (Figure 25). With and without the bushing fitted, a force of 70 kN could be sustained. With the bushing fitted, a rotation of 2° could be determined in the rod assembly.

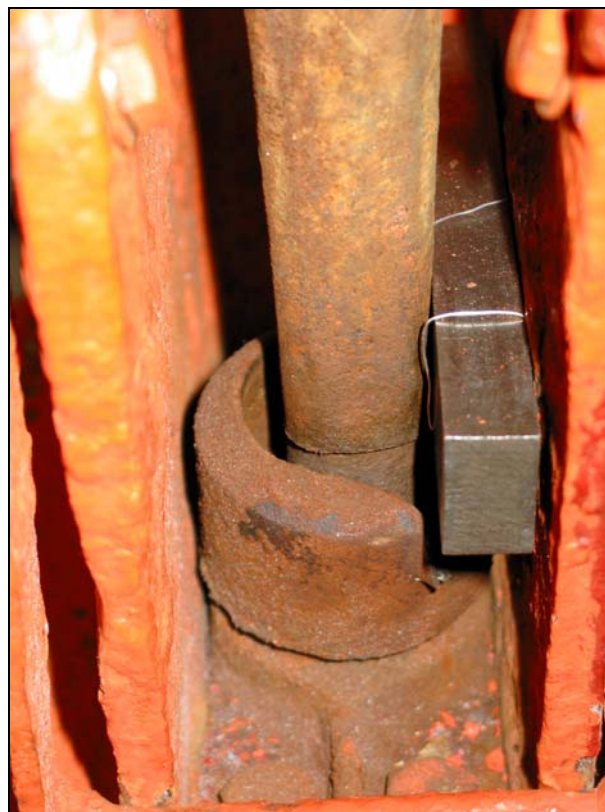


Figure 25: Aft releasing hook with wedge added

6 Analysis

6.1 Manuals

There were no manuals on board the FOREST-1 to describe the operation of the release system and/or the maintenance of the boat, the davits or the winch. No inspection or maintenance log was kept. Thus on the one hand it was hardly possible for the crew to notice the absence of certain components on the releasing hooks, and on the other hand the absence of such documentation constituted a violation of the stipulations of SOLAS Chapter III Rule 36.

The “Manual for Training and Instruction” available on board was formulated so as to apply to several different types of lifeboats. The explanations found in the manual in regard to the winch crank handle is of a basic nature and applies to all winches, as winch handles turning with the winch represent a serious danger⁶.

6.2 Operation error and overload

Leaving the winch crank handle on the winch after the first drill was an operating error. The consequence of this operating error was a heavy load on the releasing system of the starboard side lifeboat. The error occurred on the one hand because the crew member in charge did not pay enough attention to his actions. On the other hand, the proceedings at the drill station were evidently only insufficiently checked and/or supervised by higher ranking crew members. This circumstance was exacerbated by the fact that, except for the Master, all officers were in the lifeboat.

In the opinion of the BSU, the severe load exercised on the releasing system as a result of the operating error was not primarily responsible for the crash of the lifeboat. Such stresses can, among other things, also be generated by a jump of the wire on the winch drum and should be within the design safety parameters.

6.3 Manual release

In the opinion of the BSU, intentional manual release of the releasing hook system can be ruled out. Even though the boat crew may only have had scant knowledge of the release system, this particular boat crew had already carried out two drills, one of which had also included the release manoeuvre. The position of the release lever is explained by the situation in the stern of the boat following the crash, when two people as well as equipment items fell tumbling through the interior of the boat.

6.4 Lifeboat

The lifeboat did fundamentally meet the relevant requirements. Its maintenance condition was insufficient in parts. The inadequate availability for use of the safety belts led to the boat's crew falling into the stern of the lifeboat when the aft releasing hook released. The situation of the seamen worsened when the boat struck, and even more when water started entering and the stern sank. Broken off and loose equipment, such as packaged immersion suits, seat bolsters, head rests and oars restricted self-rescue options. This resulted in that only three of the six crew

⁶ Cf. BSU Investigation Report 134/04

members were able to escape from the lifeboat. Wearing a solid material life vest did not prevent the death of one of the seamen recovered from the stern of the boat.

6.5 Technical acceptance

The Cargo Ship Safety Equipment Certificate had been issued on 3 May 2007, i.e. 13 days before the accident. Because the report was missing, it was not possible to ascertain to what extent a ship inspection had been carried out within the scope of the issuance of the certificate, and what findings had been recorded on that occasion. In the opinion of the BSU, the defects of the aft release system should have been noticed in the course of an inspection by the classification society.

The document concerning a lifeboat and davit test performed at the LP – Brodogradilište yard and dated 12 October 2006 did not enable unequivocal determination of whether the tests had been carried out according to LSA Code 6.1.2.5. Thus the winch was probably not subjected to any dynamic tests. It was also not possible to ascertain to what extent the yard would have worked with a classification society in order to be approved to conduct testing.

According to Chapter I Rules 7 and 8, SOLAS requires regular inspection of life saving appliances. According to Chapter III Rule 11.2 these inspections must be carried out by technically trained persons familiar with the system. Rule 11.3 requires overhaul and inspection of the release system at least once every five years. As a result of the investigation of the present casualty and the findings from the investigation in relation to the crash of the lifeboat of the MSC GRACE off Bremerhaven, the BSU is confronted with a specific set of problems. In both cases, the crew used lifeboats that have not been manufactured for over ten years. As there are no successor businesses, the warranty is in fact void. There are also no authorised workshops or yards.

This deficiency cannot be remedied by the crews, as they cannot be considered to be professionally trained persons familiar with the system, last but not least as a result of the lack of manuals and technical drawings.

The flag state, the appointed inspectors and/or the organisations recognised by the flag state, i.e. the classification societies, are trying to find a solution by trying to identify workshops that would be suitable for carrying out service. The BSU questions such suitability. These workshops have neither manuals and technical drawings nor the essential spare parts. Qualified maintenance is therefore, also because of the multiplicity of release systems manufactured worldwide, highly uncertain. As a result, such maintenance harbours not only a danger for the crews, but also represents a risk for the maintenance business engaged in the guarantee system.

Based on evaluation of similar accidents, the flag states should, where appropriate, conclude that lifeboats whose technology – more particularly of their releasing hooks and release mechanism – can no longer be maintained, should have their approval withdrawn. Alternatively, a replacement releasing hook system could be an option.

6.6 Signage

The requirements resulting from SOLAS Chapter III Rule 9 in regard to instructions for use were complied with as concerns the davit system by means of pictograms and text posted in the boat deck area. The directions in the lifeboat, on the other hand, were entirely insufficient. Neither instructions for use nor warnings were posted

there. It is inconceivable that this circumstance did not come to notice during the inspections and did not attract criticism at the time.

6.7 Boat drills

The following obligation exists according to SOLAS Chapter III 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.” This requirement was not met by the crew of the FOREST-1. The BSU was unable to ascertain to what extent the crew did actually carry out muster drills.

6.8 Releasing hooks

The expert’s inspection of the aft releasing hook revealed that as a result of the missing components bushing and wedge the releasing hook was no longer safe for operation. Although under static loads the system was able to attain adequate values, the simulated dynamic load was closer to reality and thus more meaningful. When re-enacting the situation found after the crash, i.e. aft releasing hook without bushing and wedge, release occurred at 56 kN. This was equivalent to twice the boat weight plus six people. The aft releasing hook therefore released at a load that fell within the normal range for a lowering manoeuvre. The release situation becomes clearer when compared with the fully manned boat. At a weight of 6,660 kg (4,260 kg according to the certificate + 32 people) the releasing hook would have released at 1.7 times the load (1.7 x SWL).

The tests performed show that the missing wedge was the determining cause for the failure of the releasing hook. The absence of this component allowed the releasing hook tail to deflect to port. The now eccentric force caused severe torsion of the release rod assembly in itself, i.e. causing it to twist open, subsequently enabling release.

Deficient maintenance and control by the crew resulted in the missing parts not being noticed and/or replaced.

6.9 Summary

Because of the missing aft releasing hook components the releasing hook could have released during any other lowering process too.

On 16 May 2007 the release was favoured by the jamming of the boat winch and the resulting peak loads.

The reason for the jam was an operating error on the part of the winch operator. The actual cause of the accident however was the – at the very least inadequately performed – maintenance of the releasing hook system. These maintenance duties were primarily the crew’s responsibility.

The absence of the Operations and Maintenance Manual on board, made the crew’s job more difficult. However, even a simple visual comparison with the forward releasing hook would have made it possible to detect the difference.

7 Safety recommendations

As concerns fundamental findings and the safety recommendations 1 to 3, the Federal Bureau for Maritime Casualty Investigation makes reference to its investigation of the lifeboat accident of the OLIVER JACOB – 21/06.

7.1 Operators

The Federal Bureau of Maritime Casualty Investigation recommends to 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,
- equip the lifeboats with the recommended pictographs that describe the handling of the release technology.

7.2 Vessels command

The Federal Bureau of Maritime Casualty Investigation recommends that the vessels command should observe the manuals for the proper handling of release hook systems in operation, drills and maintenance.

7.3 Classification societies

The Federal Bureau of Maritime Casualty Investigation recommends that the 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.

7.4 Federal Ministry of Transport, Building and Urban Affairs

The Federal Bureau of Maritime Casualty Investigation recommends that the Federal Ministry of Transport, Building and Urban Affairs should, within the relevant bodies of the International Maritime Organisation IMO, initiate a procedure to ensure that release systems whose manufacturer exists no longer or for which authorised maintenance is no longer possible as a result of the absence from the market of the manufacturer and/or its legal successor are either entirely replaced, or that the respective lifeboat is placed out of service. Third party maintenance should always be questioned.

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

8 Sources

- Findings of the Emden Waterways Police
- Written statement by the vessel's command
- Witness statements
- Documents obtained from the Classification Society Germanischer Lloyd
- Expert opinion of Marine Consultant Jan Hatecke, Grad. Eng., concerning the central release releasing system of the starboard side lifeboat of the FOREST-1, commissioned by the Aurich Office of the Public Prosecutor
- SOLAS 1974, Chapter III
- MSC/Circ. 1049, 1093, 1136, 1137, 1205, 1206
- Publication by the International Life Saving Appliances (LSA) Codes in connection with decision MSC. 48(66)
- Illustrations:
 - Fig. 1 Federal Maritime and Hydrographic Agency
 - Figs. 2, 4, 5, 9, 11 Emden Waterways Police
 - Figs. 3, 7, 10, 12, 15-25 BSU
 - Fig. 6 See-BG
 - Fig. 8, 13, 14 Expert opinion by Marine Consultant Jan Hatecke, Grad. Eng.