

# Investigation report

Report	
Report title Investigation of lifeboat incident of 14 January 2015 on <i>Mærsk Giant</i>	Activity number 400003004

Security grading		
<input type="checkbox"/> Public	<input type="checkbox"/> Restricted	<input type="checkbox"/> Strictly confidential
<input type="checkbox"/> Not publicly available	<input type="checkbox"/> Confidential	

Summary
<p>An unintentional launch of lifeboat number 2 occurred on <i>Mærsk Giant</i> at about 05.10 on Wednesday 14 January 2015. The PSA was notified at 08.20.</p> <p>When the incident occurred, two inspectors from Westcon Løfteteknikk as the enterprise of competence were conducting a periodic competent control of the lifeboat davits together with maritime personnel from Mærsk Drilling Norway (MDN). As part of this check, a dynamic braking test was to be conducted. This involved lowering an empty boat at full lowering speed and halting its descent with the aid of a manual brake.</p> <p>The lifeboat was first lowered and halted, but had not descended fast enough and the enterprise of competence requested a repeat of the test. Lowering of the lifeboat resumed until full speed was reached and then halted on the brake. Nothing abnormal was observed.</p> <p>Following the brake test, the lifeboat was hoisted back up. The crane operator had brought the boat up a little way when the winch stopped. The operator checked whether the electrical limit switch was activated before hoisting resumed. The lifeboat then began to descend. Efforts were made to activate the manual brake on the lifeboat winch, but it was not working. The lifeboat entered the water, and the steel wires holding it were eventually torn off.</p> <p>The direct cause of the incident was that the braking effect of the manual brake had been reduced owing to faulty adjustment of the manual brake control handle.</p> <p>Since the brake was only partially effective, exactly how much weight change was required to release it cannot be established. But a potential existed that the lifeboat could have begun to descend with a person on board during maintenance work. The possible consequence under the prevailing weather conditions is estimated to be serious personal injury. Should the lifeboat have begun to descend during an actual evacuation, a partially filled lifeboat could have reached the sea without a lifeboat captain on board. We also consider it likely that people would have been at risk of falling from the lifeboat or the muster area should a descent have begun. The potential consequence could be fatalities.</p>

Involved	
Main group T-F Mobile	Approved by/date Leif J Dalsgaard
Members of the investigation team Bjarte Rødne	Investigation leader Anne Marit Lie

## **Contents**

(Må lages på nytt)

## 1 Summary

### Course of events

An unintentional launch (descent to the sea) of lifeboat number 2 on the starboard side of *Mærsk Giant* occurred at about 05.10 on Wednesday 14 January 2015. The Petroleum Safety Authority Norway (PSA) was notified at 08.20 on the same day.

When the incident occurred, two inspectors from Westcon Løfteteknikk as the enterprise of competence<sup>1</sup> were conducting a periodic competent control<sup>2</sup> of the lifeboat davits together with maritime personnel from Mærsk Drilling Norway (MDN). As part of this check, a dynamic braking test was to be conducted. This involved lowering an empty boat at full lowering speed and halting its descent with the aid of a manual brake. Such a test had already been conducted earlier that night on lifeboat number 4 with an approved result.

An operations and maintenance roustabout from MDN was positioned on the platform above lifeboat number 2 in order to lower the lifeboat by lifting the weighted handle which keeps the manual brake engaged on the steel lifeboat wire. A crane operator from MDN stood on the deck at lifeboat level in order to operate the lifeboat winch. Lifeboat number 2 was first lowered and halted, but it had not descended fast enough and the enterprise of competence requested a repeat of the test. Lowering of the lifeboat resumed until full speed was reached and then halted on the brake. Nothing abnormal was observed. Following the brake test, the lifeboat was hoisted back up. The crane operator had brought the boat up a little way when the winch stopped. The operator checked whether the electrical limit switch was activated before hoisting resumed. The lifeboat then began to descend. Efforts were made to activate the manual brake on the lifeboat winch, but it was not working. The lifeboat entered the water, and the steel wires holding it were eventually torn off.

### Weather conditions

Wind 223 degrees, 30-37 knots

Wave height 4.3m significant (Hs)

Wave height 7.6m maximum

### Consequences

The actual consequence was the loss of lifeboat number 2.

The lifeboat posed no threat to *Mærsk Giant*'s structure/legs. *Mærsk Giant* is positioned as an accommodation unit on Yme, and has no current drilling activity. Nor is the lifeboat considered to have represented any risk or threat had a drilling operation been under way from *Mærsk Giant* at the time of the incident.

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<sup>1</sup> *Enterprise of competence* – has sufficient theoretical knowledge and practical experience to understand calculations for lifting equipment, its design and function, and to carry out necessary examinations and tests in order to issue certificates (section 92 of the activity regulations, see the guideline which refers to Norsok R-003, 3.1.33).

<sup>2</sup> *Competent control* – control carried out by an enterprise of competence in order to verify that lifting equipment satisfies relevant requirements and is designed, embedded, installed, set up, tested, documented and maintained in such a way that use of the lifting equipment is fully justified (section 92 of the activity regulations, see the guideline which refers to Norsok R-003, 3.1.31).

The lifeboat was accompanied by a standby vessel to control and monitor it. The boat later drifted ashore at Obrestad south of Stavanger.

### **Potential consequences**

Should the manual brake fail during maintenance with people in the lifeboat, or during an actual evacuation under the prevailing weather conditions, serious personal injury or deaths could have been suffered.

### **Investigation**

The PSA decided on Wednesday 14 January 2015 to conduct its own investigation of the incident, with departure for *Mærsk Giant* the same evening.

### **Nonconformities**

Five nonconformities were identified by the investigation. These related to

- maintenance routines for the lifeboat davit system
- training
- procedures relating to lifeboats and evacuation
- periodic programme for competent control and ensuring the expertise of personnel carrying out maintenance work
- qualification and follow-up of contractors.

Two improvement points were also identified in relation to the incident.

## 2 Introduction

*Mærsk Giant* is a jack-up drilling rig. It was built in 1986 and received an acknowledgement of compliance (AoC) on 15 February 2002. The facility flies the Danish flag and is classed by Lloyd's Register.

Consent to use *Mærsk Giant* as an accommodation unit on the Yme field was issued on 11 September 2014.

*Mærsk Giant* has a total of four conventional davit-lowered lifeboats, of which two are of the Waterman type with a Schat FDA 101/22 davit installed in 1994. This was the installation involved in the incident.



Figure 1: *Mærsk Giant*, source [Mærskdrilling.com](http://Mærskdrilling.com)

During work on competent control of the lifeboat davits, an unintentional launch of lifeboat number 2 on the starboard side of *Mærsk Giant* occurred at about 05.10 on Wednesday 14 January 2015. There were no people in the lifeboat.

Weather conditions reported immediately after the incident were wind from the south-west, 30-37 knots. Wave height was 4.3m Hs and 7.6m maximum. When the incident occurred, two inspectors from Westcon Løfteteknikk as the enterprise of competence were conducting a periodic competent control of the lifeboat davits together with maritime personnel from MDN. The lifeboat descended completely to the sea, and the steel wires holding it were torn off because of the weather conditions.

Ninety-five people were aboard *Mærsk Giant*. Nobody was injured in the incident.

The PSA decided on 14 January 2015 to conduct its own investigation of the incident. The investigation team went offshore on 14 January 2015 and returned to land on 16 January 2015.

Composition of the investigation team:

- Anne Marit Lie      F-Logistics and emergency preparedness, emergency preparedness, investigation leader
- Bjarte Rødne      F-Logistics and emergency preparedness, logistics

We conducted our own interviews offshore with those involved in the incident, the lifeboat captain, the electrician, the technical manager, the head of the marine section and a representative from Harding, the manufacturer of the equipment involved in the incident.

An inspection was conducted at the incident site, and disassembly of the winch brake was observed.

A concluding meeting was held to present the status of the investigation with preliminary findings. Interviews were subsequently conducted on land with the technical vice president of MDN, the technical inspector for *Mærsk Giant* and the MDN procurement department.

Documentation was acquired during our stay offshore and investigation on land.

Mandate for the investigation

- a. *Clarify the incident's scope and course of events, with an emphasis on safety, working environment and emergency preparedness aspects*
- b. *Assess the actual and potential consequences*
  1. *Harm caused to people, material assets and the environment.*
  2. *The potential of the incident to harm people, material assets and the environment*
- c. *Assess direct and underlying causes*
- d. *Discuss and describe possible uncertainties/unclear aspects*
- e. *Identify nonconformities and improvement points related to the regulations (and internal requirements)*
- f. *Assess the player's own investigation report. Prepare a report and a covering letter (possibly with proposals for the use of reactions) in accordance with the template*
- g. *Recommend and possibly contribute to further follow-up of the incident by the PSA over and above the investigation work carried out*

### 3 Course of events

#### *Introduction*

Lifeboat number 2 is lowered with the aid of gravity. A manual brake normally holds it in the correct position in the davit. When the brake is released, the lifeboat is lowered. The manual brake can be released either from the lifeboat with the aid of a dedicated steel wire, which connects to the manual brake control handle via a pulley system, or directly using the manual brake control handle. The latter is positioned on the rig above the lifeboat system (see figure 2). A governor brake ensures a controlled lowering speed in the event of an evacuation.

A dedicated electric motor is used in combination with a winch to hoist the lifeboat back up after a function test or exercise/training. The lifeboat can also be hoisted up manually if something should go wrong with the winch or the electric motor.

Lifeboat crew on *Mærsk Giant* do not get into the lifeboat during training or exercises. This reflects a long history of serious incidents with davit-launched lifeboats generally in the maritime industry.

During maintenance which takes some time, the lifeboat is hung off on safety chains. Should the work be of short duration (such as check of radio, battery, lights, etc), the boat is not hung off. An unwritten rule was conveyed in interviews on *Mærsk Giant* that the lifeboat is not hung off on the safety chains during maintenance if doing so would take longer than the work.

When the lifeboat is hoisted back into place, two limit switches turn off the electric motor when the lifeboat reaches its normal position to prevent it being drawn into the davit structure.

The manual brake in the launch system is maintained annually on *Mærsk Giant* by a third-party contractor. This work, which includes opening the brakes, a visual check and measuring the brake shoe lining, is done in accordance with MSC.1/Circ 1206. Competent control of the launch system is performed by an external enterprise of competence, which is not the same company doing the annual maintenance. These two activities were done some months apart on *Mærsk Giant*. The most recent annual maintenance was in August 2014. Competent control, due in January 2015, was under way when the incident occurred.



Manual brake control handle

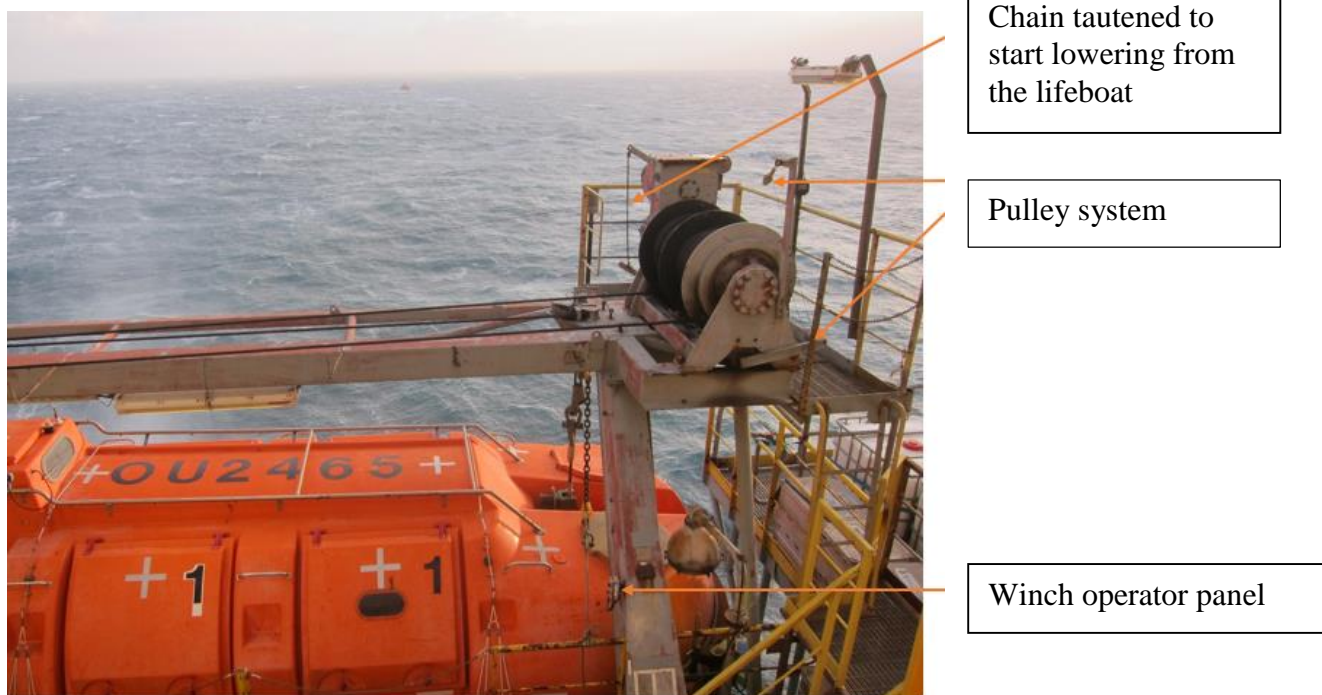


Figure 2: Two photos of the corresponding port-side lifeboat and winch system on *Mærsk Giant*.

### *Course of events*

Lifeboat davit 2 on the starboard side was to undergo periodic competent control. This includes checking the function of the manual brake through a dynamic test with an empty boat. The test was conducted twice, since full lowering speed had not been achieved when the brake was applied the first time. After the second approved test, the boat was to be hoisted back into position in the davits. The manual brake is then in its normal position, which means it is engaged. It is released while hoisting with the winch.

An operations and maintenance roustabout from MDN was positioned on the platform above lifeboat number 2 in order to lower the lifeboat by lifting the weighted handle which keeps the manual brake engaged on the steel lifeboat wire. A crane operator from MDN stood on the deck at lifeboat level in order to operate the lifeboat winch. Two inspectors from Westcon Løfteteknikk as the enterprise of competence witnessed the test from deck level. An MDN electrician working in the area also observed much of what happened. The brake test had a work permit and a documented Toolbox talk had been conducted. All personnel worked inside the railings in a secure area.

Lifeboat number two was first lowered and halted, but lacked sufficient speed in this test and the enterprise of competence asked for it to be repeated. Lowering of the lifeboat continued until full speed was reached and the brake applied. None of the personnel observed anything out of the ordinary. The lifeboat was then hoisted up again after the brake test. After the crane operator had brought it up a short distance, the winch stopped. The crane operator checked whether the electric limit switch had been activated before hoisting resumed. As the crane operator started hoisting again, he thought he heard a sound and the winch began to lower the lifeboat at normal speed

MDN personnel sought to halt the descent. Both the roustabout and the crane operator applied their full body weight to the manual brake control handle without effect.



Lifeboat 2 descended to the sea, and the steel wires were quickly torn off. It was drawn beneath the rig because of the prevailing weather conditions.

The lifeboat was accompanied away from the Yme field by the standby vessel.

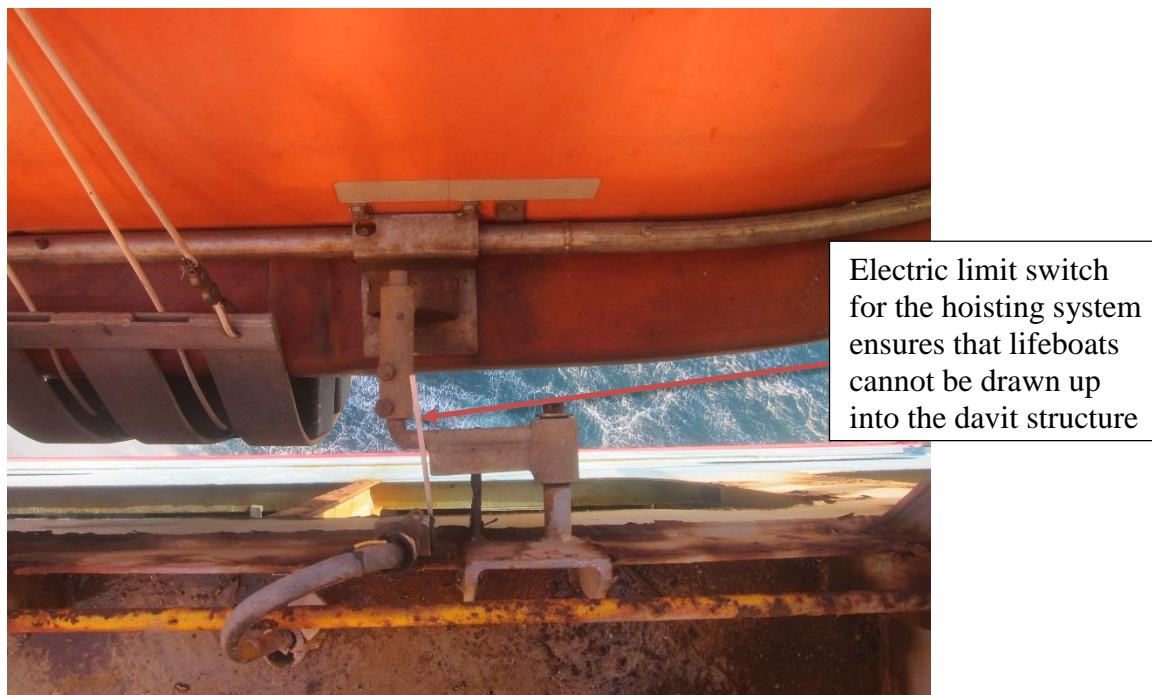


Figure 3: Electric limit switch.

### *Chronology*

1994 Lifeboat davit number 2 receives its first certification at the factory.

3 June 2011

Previous overload test conducted in connection with five-year class survey of lifeboat davits.

17 August 2014

Monthly maritime maintenance of davit winch. Documented as OK in maintenance system.

22 August 2014

Annual maintenance by Survival Craft Inspectorate Norge AS. Most recent documented opening of the brakes on lifeboat davit 2.

18 September 2014

Monthly maritime maintenance of davit winch. Documented as OK in maintenance system.

October 2014

Most recent time when lifeboat 2 was in the water, with functional testing of the lifeboats for the applicable air gap following *Mærsk Giant*'s arrival at its new location on Yme. This is not documented in the maintenance system, but in a brief sentence in the handover document between the marine section heads on board.

18 October 2014

Monthly maritime maintenance of davit winch. Documented as OK in maintenance system.

11 November 2014

Monthly maritime maintenance of davit winch. Documented as OK in maintenance system.

16 December 2014

Monthly maritime maintenance of davit winch. Documented as OK in maintenance system.

9 January 2015

Monthly maritime maintenance of davit winch. Documented as OK in maintenance system.

13 January 2015

Work permit for visual inspection and function test of lifeboat approved for night shift.

14 January 2015, about 05.00

Toolbox talk conducted between personnel involved in the function test.

14 January 2015

Dynamic brake test of lifeboat davit number 4 conducted and witnessed by Westcon Løfteteknikk as the enterprise of competence.

14 January 2015 about 05.10

Dynamic brake test of lifeboat davit number 2 conducted and witnessed by Westcon Løfteteknikk as the enterprise of competence.

Lifeboat 2 descends to the sea while being returned to normal condition after the approved test had been completed.

Lifeboat 2 loses the two steel wires attaching it to *Mærsk Giant*. Drifts away from Yme.

## 4 Direct and underlying causes

### 4.1 Direct causes

The manual brake on davit number 2 was in the position shown in figure 3, with the manual brake control handle tilted down.

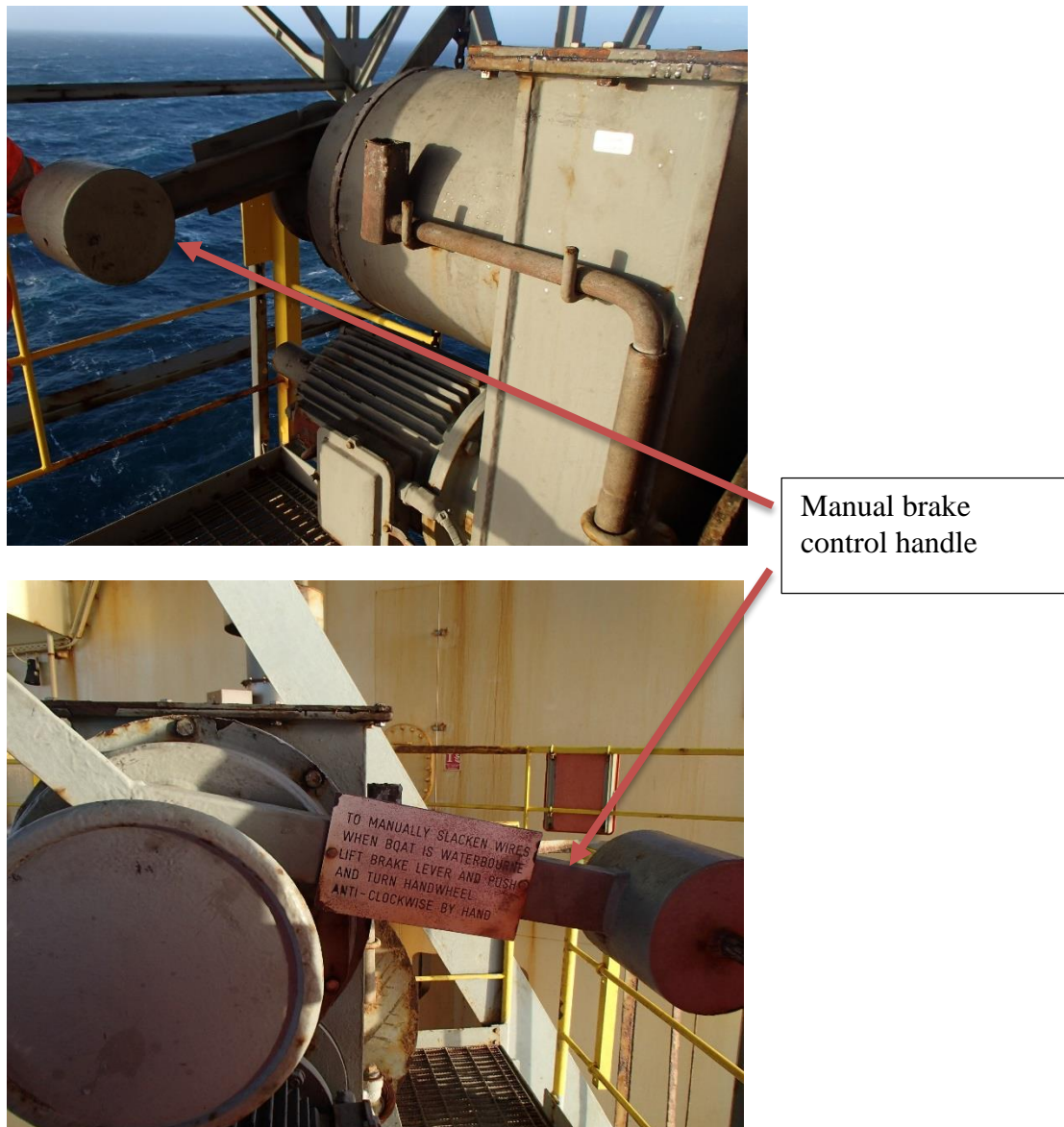


Figure 4: Two photos showing the manual brake control handle for lifeboat 2 after the incident.

The user manual for the davit specifies that the manual brake control handle must either be in a horizontal position or adjusted to a raised angle of 10-15 degrees to ensure a fully functional brake.

When the control handle is tilted down, the chain which should be tautened to lower the lifeboat will already be taut. This means in turn that the braking effect of the manual brake will be reduced because the weight on the end of the handle cannot exert sufficient moment on the braking mechanism.



Figure 3: Overview of the winch system on the corresponding port-side davit.

The chain connected to the lowering mechanism in the lifeboat. This must be slack for the weighted handle to be effective. The functionality of the manual brake is reduced if the chain is taut and prevents full activation of the weight on the manual brake handle.

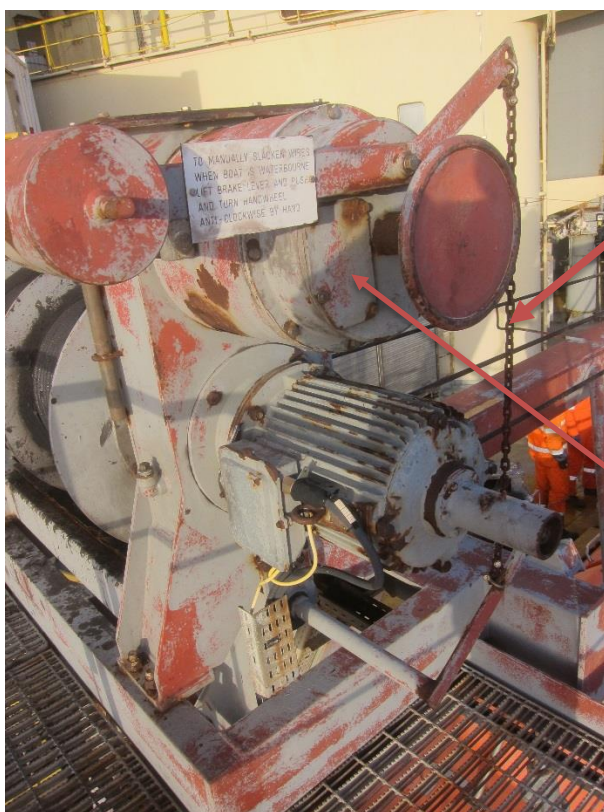


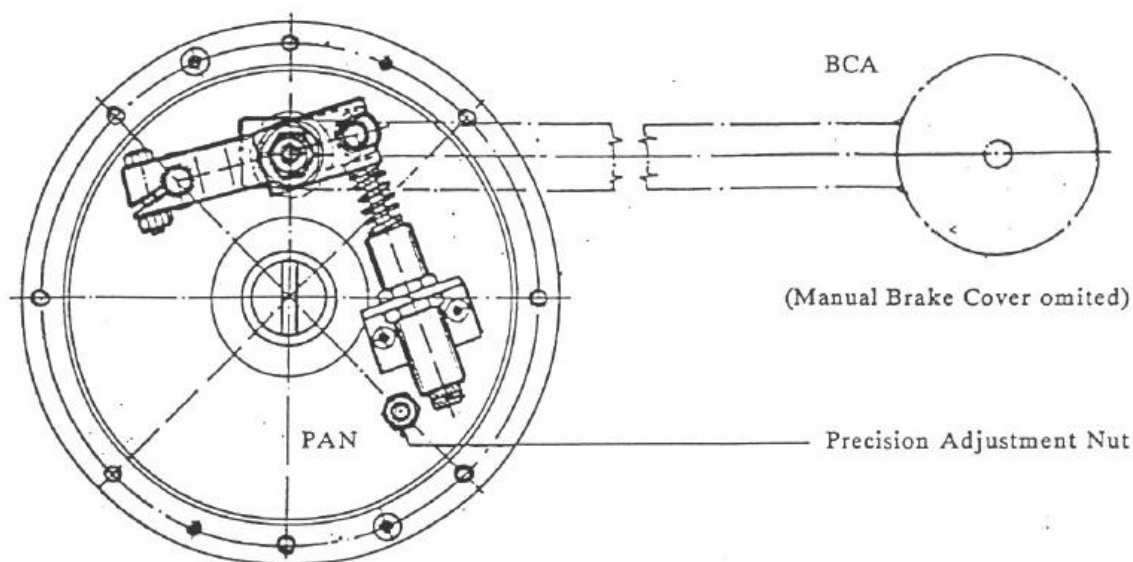
Figure 4: The corresponding port-side davit with the manual brake control handle and chain connected to the lowering mechanism.

The precision adjustment nut is beneath this cover.

### FUNCTIONAL CHECK AND BRAKE ADJUSTMENT PROCEDURE

A properly adjusted brake is characterised by a horizontal or slightly (up to 10 to 15 degrees) raised position of the BCH control handle.

(Right handed configuration of the winch controls shown)  
(the left handed one is symmetrical - see next page)



The brake needs to be re-adjusted as soon as the weighted handle extremity drops below the above horizontal level or the brake starts to develop a slipping tendency.

Figure 7: Cross-section of the relevant davit from the user manual.



The precision adjustment nut is accessible after removing a cover.

Figure 8: The precision adjustment nut.

We find it highly probable that the brake has not been adjusted with the aid of the precision adjustment nut since its most recent annual maintenance by Survival Craft Inspectorate Norge AS on *Mærsk Giant* in August 2014, and that full braking effect has therefore been absent.

The governor brake functioned as intended. No wear or mechanical fault was observed when inspecting the brake system following disassembly after the incident

## **4.2 Underlying causes**

### **4.2.1 Maintenance system**

The work description in the maintenance system fails to provide sufficient detail on the work to be done during monthly maintenance of the lifeboat davits. Interviews also indicate that maintenance personnel have differing interpretations of the content. One consequence is that maintenance work is not standardised. See nonconformity 6.1.1.

Reporting and formal documentation for six-monthly planned maintenance is lacking. The requirement in the maintenance plan is that the lifeboat must be launched to the sea at six-monthly intervals. The lifeboats were not launched during the most recent planned maintenance because they were launched two months earlier when arriving on Yme. The only documentation for this is a handover document between marine section heads which states that “lifeboats have been dipped”.

Actions described in the report from the annual maintenance conducted by Survival Craft Inspectorate AS have not been recorded or followed up in the maintenance system. See nonconformity 6.1.1.

Annual maintenance in 2012, 2013 and 2014 was conducted by different contractors each time.

### **4.2.2 Expertise and training**

A limited description is provided of the content of training for the lifeboat system. See nonconformity 6.1.2.

Generally speaking, knowledge of and familiarity with the content of the user manual for lifeboat davits is lacking. That applies to both MDN operators and management personnel on board who are responsible for using and maintaining davits. Inadequate knowledge of the user manual’s content has also been identified at Survival Craft Inspectorate Norge AS, the third-party company involved in davit maintenance, and at Westcon Løfteteknikk as the enterprise of competence for davits.

### **4.2.3 Design**

The chain must have a certain amount of slack to achieve the full effect of the manual brake, which is permanently engaged when the lifeboat hangs in the davits. A taut chain can prevent the full moment being applied to the weight on the manual brake control handle and thereby limit the braking effect. This represents a very vulnerable design for the chain connected to the manual brake. See also the comments in section 6.2.1.

## **5 Actual and potential consequences of the incident**

### **5.1 Consequences of the actual course of events**

The actual consequence of the incident was the loss of the lifeboat.

No danger was presented to personnel associated with the planned brake test. The work position for everyone involved was inside the railings.

The lifeboat presented no threat to *Mærsk Giant*. This facility is positioned as an accommodation unit on Yme and has no current drilling operations.

### **5.2 Potential consequences**

#### **5.2.1 Risk for personnel conducting maintenance**

It emerged during conversations that the lifeboat was not hung off in the safety chains during short maintenance jobs and function-testing of equipment on board.

Had the lifeboat been parked after the first brake test, it is very uncertain how long it would have remained hanging.

Since the brake was only partially effective, exactly how much weight change was required to release it cannot be established. But a potential existed that the lifeboat could have begun to descend with a person on board during maintenance work. The possible consequence under the prevailing weather conditions is estimated to be serious personal injury.

#### **5.2.2 Risk for personnel in an actual evacuation.**

Mærsk has routines for the way evacuation by lifeboat is to take place, but these do not specify where the lifeboat captain should be. We were given varying feedback during conversations on whether the captain should be in place before passengers enter the boat, whether they should participate actively in positioning personnel in the boat, or whether they should be the last person to come aboard.

Should the lifeboat have begun to descend during an actual evacuation, a partially filled lifeboat could therefore have reached the sea without a captain on board. We also consider it likely that people would have been at risk of falling from the lifeboat or the muster area should a descent have begun. The potential consequence could be fatalities.

## **6 Observations**

The PSA's observations fall generally into three categories:

- nonconformities: observations where the PSA believes that regulations have been breached
- improvement points: observations where deficiencies are found, but insufficient information is available to establish a breach of the regulations
- other observations.

## 6.1 Nonconformities

### 6.1.1 Maintenance routines

#### Nonconformity

Monthly maintenance routines for lifeboat davits do not accord with the recommendations in the user manual. No follow-up of comments in the service report of August 2014.

#### Grounds

It transpired from inspection and interviews with operators that views differed about how the monthly maintenance of the lifeboat davits should be conducted. The routine in the user manual specifies that the manual brakes should be function-tested. This is not reflected in Mærsk's monthly maintenance programme.

Varying explanations were also provided on such issues as how monthly maintenance should be carried out. A checkpoint in the monthly routine for the marine department states "check brake lever for free operation", without saying anything about how this should be done, or what constitutes acceptable operation or possible fault mode for the function.

The annual maintenance service report dated 22 August 2014 specifies that the sprinkler system must be tested the next time the lifeboat is launched to the sea. This item in the service report has not subsequently been actioned in the maintenance system.

#### Requirements

*Section 45 of the activities regulations on maintenance*

*Section 47 of the activities regulations on maintenance programme, see Norsok R-003 appendix G*

### 6.1.2 Training

#### Nonconformity:

Inadequate equipment-specific training for Mærsk personnel involved in using and maintaining the lifeboat davit system.

#### Grounds

Mærsk had developed its own on-the-job training (OJT) for safety equipment and firefighting, which specifies checkpoints for training of personnel involved with the launch system. Both checkpoints and the explanation of the system were formulated in very general terms. No references were provided, for example, to the user manual for the lifeboat davits. It was not possible to identify through the OJT that trainees who have taken the course acquired the necessary knowledge of components and checkpoints. Conversations with personnel involved also revealed that none of the operators carrying out monthly maintenance were aware of the importance of the manual brake control handle's position. Nobody checked the chain which releases the brake from the lifeboat during the monthly maintenance. The chain is not described in the checklist as a separate checkpoint.

#### Requirement

*Section 21 of the activities regulations on competence, see Norsok R-003 appendix B*



### 6.1.3 Procedures relating to lifeboats and evacuation

#### Nonconformity

Lack of clarity in several procedures dealing with lifeboats and evacuation.

#### Grounds

Interviews with both operators and management personnel on board revealed a lack of clarity in several procedures dealing with lifeboats and evacuation. Examples of such procedures/instructions include point 60 in the *Pre rig move – operational checklist 005/JUL 2014*, which specifies the need to check that all lifesaving equipment is ready for use with the relevant air gap at the location. Conversations revealed that this point should have been included in *After rig move – operational checklist 001/Oct 2014*. Nor was there any documentation that the lifesaving equipment had been launched to the sea on location, apart from a comment in the barge engineers' handover.

The evacuation procedure – *Launching of lifeboats – process checklist 005/Oct 2014* – does not describe how where the lifeboat crew should be positioned in the event of an actual evacuation. Interviews revealed that views differed among the crew about how this should be done. Some maintained that the captain should enter the boat before passenger boarded, others that they should wait until everyone was aboard. These ambiguities mean that lowering could commence in an actual evacuation without the lifeboat crew being on board.

The actual training and practice provided for the lifeboat captain's duties is unclear, since people do not enter the lifeboat during training or exercises.

#### Requirement

*Section 24 of the activities regulations on procedures*

### 6.1.4 Periodic programme for competent control and ensuring the competence of personnel carrying out maintenance work

#### Nonconformity

The periodic programme describing competent control of the lifeboat davits was deficient. Operators involved in maintaining the lifeboat davit system lacked the necessary competence.

#### Grounds

Mærsk bases the safety of lifting equipment on Norsok R-003N with appendix H – enterprise of competence. This appendix specifies in part that a programme must be drawn up which describes competent control for each type of lifting equipment in connection with periodic checks. Where *Mærsk Giant* is concerned, this programme for the lifeboat davits is formulated in general terms without details concerning the type of design involved.

Conversations and verifications revealed that personnel involved in maintaining lifeboat davits lacked equipment-specific competence. That applied to both operators on the facility and the external enterprise of competence conducting periodic competent control.

Conversations with both Mærsk's operators and the personnel conducting periodic competent control revealed unfamiliarity with important individual components in the launch system, such as the chain and the position of the manual brake control handle. This is directly related to the inadequately prepared programme for competent control of this lifting equipment.

## **Requirements**

*Section 21 of the activities regulations on competence, see Norsok R-003 appendix B*  
*Section 47 of the activities regulations on maintenance programme, see Norsok R-003 appendix H*

### **6.1.5 Qualification and follow-up of contractors**

#### **Nonconformity**

Qualification and follow-up of suppliers conducting annual maintenance and annual competent control of lifeboat davits are deficient

#### **Grounds**

The contractors carrying out annual maintenance of lifeboat davits and the personnel conducting competent control were shown by inspection and conversations respectively to lack the expertise required to maintain the equipment in a safe condition. This conclusion reflects the fact that the most recent annual maintenance of the manual brake reveals deficiencies in execution, knowledge of the user manual and awareness of the need to adjust the brake after maintenance.

MDN uses a dedicated lifting gear survey manual which describes the referenced standards and expertise requirements for personnel carrying out checks. We cannot see that Mærsk has followed up its responsibility to ensure that contractors comply with the requirements during the execution of assignments in the business.

We consider it very probable that personnel hired to conduct the annual maintenance in August 2014 lacked equipment-specific expertise and that they were not acquainted with the user manual for the equipment when carrying out the maintenance work.

## **Requirements**

*Section 18 of the framework regulations on qualification and follow-up of other participants*  
*Section 21 of the activities regulations on competence, see Norsok R-003 appendix B*  
*Section 47 of the activities regulations on maintenance programme, see Norsok R-003 appendix H*

## **6.2 Improvement points**

### **6.2.1 Work process for use of safety chains on lifeboats**

#### **Improvement point**

The work process for the use of safety chains on lifeboats is not unambiguous.

#### **Grounds**

An unwritten rule was conveyed in interviews on *Mærsk Giant* that the lifeboat is not hung off on the safety chains during maintenance if doing so would take longer than the work.

#### **Requirement**

*Section 13 of the management regulations on work processes*

## **6.2.2 System for assessing work carried out by third parties**

### **Improvement point**

No systematic approach is taken to assessing work carried out by third-party contractors on the facility.

### **Grounds**

Conversations both on the facility and on land indicated that no systematic approach is taken to assessing or providing feedback on work carried out by third-party contractors on the facility.

### **Requirement**

*Section 18 of the framework regulations on qualification and follow-up of other participants*

## **6.3 Other comments**

### **6.3.1 Original design solution for the brake system on the lifeboat davit winch**

It could be argued that the original design solution for releasing the manual brake is sub-optimal. The system is not designed and configured so that it can function, be adjusted and be maintained without exposing people to risk when operations are conducted not only under conditions the manufacturer has foreseen, but also in the event of erroneous use which could reasonably be anticipated. The chain which forms part of the system to transfer pull from lifeboat to brake has its limitations and provides opportunities for entering error mode.

### **6.3.2 Securing the incident site**

When we arrived on *Mærsk Giant*, the incident site and equipment was untouched except that the steel wires had been raised about three metres. That allowed us to follow the process of disassembling and inspecting the brake system, providing a clear picture of the technical condition and how that system looked immediately after the incident had occurred.

### **6.3.3 Mærsk's investigation**

Mærsk's investigation of the incident has been conducted at level 2 in accordance with its own M-CPH-1171-00291 investigation level matrix. Mærsk's description of the course of events and the direct and underlying causes coincides almost entirely with our own data and assessments.

Where potential consequences are concerned, the PSA considers that possible fatalities could be caused by personnel falling from the lifeboat or the muster area should the lifeboat suddenly begin to descend during an actual evacuation. Mærsk's conclusion is that this could have caused an accident, with several people suffering serious and permanent physical injury.

## **7 Barrier assessment**

We have carried out a brief assessment of which barriers functioned and failed to function. These have been assessed in relation to technical, organisational and operational barrier elements.

Time	Barriers which failed to function	Barriers which functioned	Technical elements	Organisational elements	Operational elements
	Design		Individual faults can create fault mode on the lifeboat davit		
	Maintenance system				Unambiguous description of maintenance tasks
	Training				Level of detail in equipment-specific training
	Maintenance			Inadequate knowledge of user manual for lifeboat davit	
	Manual brake		Manual brake failed		
		Ordering of competent control			In accordance with operational routines
		Annual competent control		Detects faults in lifeboat davits	
		Governor brake		Controlled speed of descent	

## 8 Discussion of uncertainties

### 8.1 Faulty operation

Faulty operation cannot be excluded, but is not regarded as likely on the basis of interviews conducted on board.

### 8.2 Fault with non-reverse clutch

The non-reverse clutch may have failed to function during the incident. Based on troubleshooting on board which investigated the condition of the clutch, such a fault is not regarded as likely.

### 8.3 Braking efficiency – frictional effect

The brake worked twice under dynamic loading, but failed to hold the lifeboat under static loading. It is not possible in retrospect to verify the actual braking effect of the incorrectly adjusted brake.

## 9 Appendices

### 9.1 Appendix A: Documents used in the investigation

- /1/ User manual lifeboat davit
- /2/ Statements from people involved in the incident
- /3/ Work permit 9000015010
- /4/ Toolbox talk “brake test lifeboat winch”
- /5/ OJT Life Boat Captain Training (SIRIUS)
- /6/ OJT Safety Equipment & Fire Fighting (SIRIUS)
- /7/ Survey Report 5 Yearly Overload Test of Launching Appliances, Davit no. 2 (DNV) (3.6.2011)
- /8/ Original certificate for lifeboat davit no 2, 8 February 1994
- /9/ Synergi 1191007 Reduced Lifeboat Capacity
- /10/ Service report 2011 from Survival Craft Inspectorate, five-year class survey
- /11/ Duties for the lifeboat captain described in the emergency preparedness manual, Rev 002/NOV 2012; Doc ID: M-CPH-1171-00832-EN-Appendix\_D\_Muster Cards
- /12/ Launch of lifeboat - exercise check-list, MODU\_Operational Checklist 007/OCT 2014, ID: M-CPH-1171-20390\_EN,
- /13/ Launching of lifeboats check-list, Process Checklist 005/OCT 2014, ID: M-CPH-1171-00986\_EN
- /14/ Pre rig-move checklist deck, *Mærsk Giant* – Operational Checklist 005, JUL 2014, ID: M-CPH-1171-30982\_EN
- /15/ Maintenance report, five-year class survey lifeboat davit 2, Hytec, 2011
- /16/ Lifting Gear Survey Manual, 003, DEC 2013, ID:M-CPH-1171-01225\_EN\_Section\_0.01
- /17/ Danbor Eddy Current Examination, Lifeboat no 2, March 2013
- /18/ Offshore order for annual maintenance of davit, May 2014
- /19/ Task List: 520202 Grp:1 – Life Boat Davits Plats P212 - Planned maintenance lifeboat davit, printed 15.01.2015
- /20/ Technical Instruction 003, SEP 2014 - structural inspection and evaluation, ID: M-CPH-1171-00435\_EN
- /21/ MODU-Technical Instruction 002/AUG 2014 - Liquid Penetrant examination, ID: M-CPH-1171-00376\_EN
- /22/ North Sea Produces - Technical Instruction 002/OCT 2014 - Magnetic Particle Examination, ID: M-CPH-1171-00378\_EN
- /23/ Technical Instruction 003/OCT 2014 - Eddy Current Examination, ID: M-CPH-1171-00355\_EN
- /24/ Mærsk investigation mandate
- /25/ One-pager after incident
- /26/ Presentation by Mærsk 26 January 2015
- /27/ Authorisation of service providers – Danish Maritime Authority
- /28/ Circular 04-2007 – Norwegian Maritime Directorate
- /29/ Maintenance history lifeboat davit no 2
- /30/ Annual maintenance report Viking 2013
- /31/ Annual maintenance report Survival Craft 2014
- /32/ Competent control checklist for davit and lifeboat system
- /33/ Requisition and procurement of equipment and services, Process Instruction 002/SEP 2010
- /34/ Mærsk Drilling investigation report, Synergi no 1190861

## **9.2 Appendix B: Overview of personnel interviewed**

This list is not published on the internet and is included in a separate document.